

DISSERTATION

PRESENCE, WHAT IS IT GOOD FOR?

EXPLORING THE BENEFITS OF VIRTUAL REALITY AT EVOKING EMPATHY

TOWARDS THE MARGINALIZED

Submitted by

Nicholas Boehm

Department of Journalism and Media Communication

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Doctoral Committee:

Advisor: Marilee Long

Michael Humphrey

Lauren Shomaker

Gayathri Sivakumar

Lorann Stallones

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ABSTRACT

PRESENCE, WHAT IS IT GOOD FOR? EXPLORING THE BENEFITS OF VIRTUAL REALITY AT EVOKING EMPATHY TOWARDS THE MARGINALIZED

This study examines the relationship between physical presence and empathy across three technology modalities: 1) virtual reality head-mount displays, 2) desktop virtual reality, and 3) text narratives with photographs displayed on a computer screen. Additionally, it examines if public support for a novel public health intervention increases when participants engage in a perspective-taking exercise designed to evoke empathy. Last, the study explores whether the benefits of empathy arousal, specifically the reduction of stereotypes toward the marginalized, depend on the technology modality used in the perspective-taking exercise.

Prior studies have consistently found a positive correlation between physical presence and fear and anxiety, especially studies that have used virtual reality head-mount displays to induce presence. However, few studies have examined the relationship between physical presence and empathy. Although some studies have found a positive correlation between physical presence and empathy, these studies are few, lack comprehensive and consistent measurement, and commonly do not test the superiority of virtual reality head-mount displays at evoking empathy against more traditional technology modalities. Last, studies using virtual reality head-mount displays have found inconsistent results in how empathy affects public support and stereotypes. A 1x4 lab experiment ($N = 199$) was carried out to fill in these research gaps.

Results include the follow: 1) physical presence was higher in the virtual reality head-mount display condition compared to the desktop virtual-reality condition and the text narrative and photograph condition; 2) physical presence was positively correlated with all four dimensions of empathy—perspective taking, fantasy, personal distress, and empathic concern; however, the relationship between presence and empathic concern was moderated by participants' mental health; 3) the amount of empathy participants experienced did not differ by experimental condition; however, cognitive empathy was lower in the control condition compared to each experimental condition; 4) public support was positively correlated with three of the four dimensions of empathy including perspective taking, fantasy, and empathic concern; 5) perceptions of stereotypes of people who inject drugs were higher in the control condition compared to the desktop virtual-reality condition and text narrative condition, but not the virtual reality head-mount display condition.

Overall, this study adds to a growing body of literature exploring the benefits of virtual-reality perspective-taking exercises in three important ways. First, this study strengthens the assertion that virtual-reality head-mount displays produce more physical presence compared to desktop virtual reality and text narratives with photographs. Second, aligned with prior research, this study provides evidence of a positive correlation between physical presence and empathy arousal. However, in this study, empathy arousal appears to be increasing presence, which is a different causal pathway than the study predicted.

Last, this study found that the virtual-reality head-mount display condition was the only experimental condition that did not significantly reduce stereotypes. Together, these results suggest both potential advantages and disadvantages for using virtual reality in perspective-taking exercises.

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CHAPTER ONE: INTRODUCTION

1.1 Introduction

I am surrounded by pillaring rock as I creep down a narrow canyon toward the station. I never imagined Saturn to look this dry and rocky, but then again, it is difficult to image what Saturn looks like. I reach out my hands and slowly open the space station door. My hands vibrate as the handle of the door shakes. I take the elevator below the surface of the station to where the fuse box is located, so I can fix the fuse and gain access to the research facility. I am encompassed by darkness as the elevator slides down the shaft. The 100-foot drop feels like forever. My claustrophobia takes hold. I am sweating and slightly nauseous, but the mission must go on.

It goes without saying that I am not actually on Saturn. There is no elevator ride, and the fuse I must fix is only part of a storyline related to a dystopian sci-fi Cold War game. I am not really a secret agent nor am I on an abandoned Soviet space base. However, the sweating and nausea is real, and despite knowing that I am not really on Saturn, I still feel physically present, involved, and engaged in the virtual environment almost as if I was there in real life.

It is important to note that these technologies are not just being used by videogaming enthusiasts. Virtual reality can provide users with unique experiences in many other areas, such as education, technical training, health and wellness, and marketing. For example, research shows that virtual-reality simulations help medical students learn surgical planning and training (Alaraj et al., 2011; Gallagher & Cates, 2004; Seymour et al., 2002), and virtual-reality exercise games can motivate both adults and children to engage in aerobic exercise (Anderson-Hanley et

al., 2011; Mestre, Maïano, Dagonneau, & Mercier, 2011). Furthermore, numerous studies have demonstrated the efficacy of using virtual reality to increase social and cultural understanding. For example, Peck, Seinfeld, Aglioti, and Slater (2013) found that light-skinned participants embodied in a virtual dark-skinned body showed a reduction in implicit racial bias against dark-skinned people. The researchers placed 60 white female participants in one of four conditions, 1) embody a light-skinned avatar, 2) embody a dark-skinned avatar, 3) embody a purple-skinned avatar, or 4) non-embodiment of any avatar. Participants were placed in a virtual environment where a dark-skinned avatar walked past them. After the experience, participants took off the head-mount display and answered a questionnaire that included the racial implicit questionnaire test. Results indicate that participants who embodied a dark-skinned avatar had a statistically significantly lower level of implicit racial bias compared to participants who embodied a light-skinned avatar. However, there was not a statistically significant difference between participants who embodied a dark-skinned avatar and participants who did not embody an avatar. Peck et al. (2013) suggest this could be a result of having all participants in the non-embodiment condition look in a virtual mirror to see their dark-skinned reflection, thus priming at least some level of avatar embodiment, despite the reflection moving asynchronous to the participant. Other researchers have created virtual representations of moral dilemmas to gain a better understanding of moral behavior (Navarrete, McDonald, Mott, & Asher, 2012; Pan & Slater, 2011).

Although some scholars have used virtual reality as a tool to study mental health (e.g., treating phobias), few have used virtual reality as a tool to foster empathy for those who are mentally ill. A small handful of studies suggest that virtual reality can be an effective tool to engage perspective-taking and empathic concern (Van Loon, Bailenson, Zaki, Bostick, and Willer (2018). However, presence has been shown to mediate the relationship between

perspective-taking tasks and empathic concern (Van Loon et al., 2018). The link between presence and empathic concern could suggest that presence, rather than the technology modality, is primarily responsible for increasing empathic concern. If this is the case, other technology modalities could increase empathic concern if a sense of presence is produced during the perspective-taking task. For example, it is possible that less sophisticated forms of technology, such as desktop virtual reality via a 360-degree video or a text narrative on a computer screen, could increase empathic concern if it produces presence.

This study aims to examine the superiority of virtual-reality head-mount displays compared to other virtual reality and non-virtual reality modalities at evoking empathy, reducing stereotypes, and fostering public support for public health policy aimed at helping people who inject drugs. The modalities compared to virtual-reality head-mount displays include desktop virtual reality and text narratives with photographs displayed on computer screens. In short, this study explores how evoking a sense of physical presence in perspective-taking exercises affects empathy arousal and the benefits of empathy arousal (i.e., stereotype reduction and public support for the marginalized).

1.2 Why Study Public Perceptions of People Who Inject Drugs?

The purpose of this study is to explore the benefits of physical presence on empathy. As such, the study could use any marginalized group as the empathy target, or it could use multiple groups to test whether effects carry across different marginalized populations. However, the author specifically focused the study on injection drug users for two main reasons. First, and more importantly, the author believes that injection drug users warrant increased attention by social science researchers as studies show that this group is especially marginalized and stigmatized, which has hindered public support for health interventions. Second, all stimuli used

in this study are publicly available and formatted to fit across multiple modalities, such as text narratives on a computer screen, 360-degree videos, and head-mount displays, essentially allowing the researcher to test the same stimuli on multiple devices.

According to the National Institute of Drug Abuse (NIDA, 2020), more than 70,200 Americans died from illicit drug and prescription opioid overdoses in 2017. This is more than four times the number of overdose deaths reported in 1999. Although many people overdosed from injecting opioids, including both prescription opioids and heroin, the rise of synthetic opioids, such as fentanyl, has significantly contributed to the increase in overdose deaths. According to NIDA (2020), synthetic opioids became the most common drugs involved in overdose deaths in America in 2016, contributing to nearly 50% of opioid-related deaths, which is up 14% from 2010.

In addition to overdose deaths, injection drug users are at risk for becoming infected with HIV and hepatitis C. According to the Centers for Disease Control and Prevention (CDC, 2018), droplets of blood can survive on a used needle for up to 42 days. Thus, injection drug users who share injection equipment, or use discarded needles, are at risk for becoming infected by HIV and hepatitis C. In general, injection drug users are 22 times more likely to get HIV compared to the general population (UNAIDS, 2018). If these rates continue, 1 in 23 women who inject drugs and 1 in 36 men who inject drugs will be diagnosed with HIV in their lifetime (CDC, 2016). Furthermore, according to the CDC (2019), transmission by injection drug use is the leading cause of hepatitis C acquisition in the United States. Hepatitis C is among the primary causes of chronic liver disease in the United States, and persons with HIV are at additional risk for accelerated progression of hepatitis C-related liver injury (Benhamou et al., 1999; Graham et al., 2001; Soto et al., 1997; Telfer et al., 1994).

People who inject drugs are also at risk for skin infections, abscesses, endocarditis, and osteomyelitis (Ebright & Piepe, 2002; O'Connor, Selwyn, & Schottenfeld, 1994). For example, Binswanger, Kral, Bluthenthal, Rybold, and Edlin (2000) found that one third of injection drug users recruited for a study in San Francisco had an abscess or cellulitis, and approximately two thirds reported a prior history of abscess. These health problems can strain community resources as injection drug users with skin infections and abscesses need hospitalization and emergency care (Binswanger et al., 2008; CDC, 2001; Kerr et al., 2005; Palepu et al., 2001; Stein & Sobota, 2001).

These studies highlight the importance of preventative care for injection drug users, not only for their safety, but for the safety and financial well-being of communities. Countries such as Canada and Australia are using evidence-based harm reduction models in addition to treatment, such as detox and rehabilitation. Although the United States is beginning to explore these models, the American public has generally shown a lack of support for harm-reducing treatment such as supervised injection facilities (Barry et al., 2019; McGinty et al., 2018).

1.3 Health Benefits and Public Perception of Supervised Injection Facilities

Supervised injection facilities are healthcare facilities managed and operated by healthcare professionals that provide high-risk injection drug users with injecting assistance. These services include providing injection drug users with sterile injecting equipment, answering questions on proper vein care, providing education on safer injection methods, offering general health advice, administering first aid, monitoring for overdose, and making referrals to drug treatment and social programs (Hedrich, 2004; Malkin, 2001; Wood, Tyndall, Qui, Zhang, Montaner, & Kerr, 2006; Wright & Tompkins, 2004).

Research has demonstrated that supervised injection facilities reduce health risks for injection drug users. For example, Milloy, Kerr, Tyndall, Montaner, and Wood (2008) found supervised injection facilities reduced mortality rates in injection drug users. Other studies found that supervised injection facilities improved addiction treatment enrollment (Debeck et al., 2011; Wood, Tyndall, Zhang, Montaner, & Kerr, 2007), reduced HIV and hepatitis C risk (Salmon, Van Beek, Amin, Grulich, & Maher, 2009), and provided access to health and social services (Potier, Laprevote, Dubois-Arber, Cottencin & Rolland, 2014; Small, Van Borek, Fairbairn, Wood, & Kerr, 2009).

Stoltz et al. (2007) examined whether consistent use of a supervised injection facility in Vancouver, Canada, impacted self-reported changes in high-risk injection practices. The study had participants ($N = 760$) complete a questionnaire at baseline as well as six months after using the supervised injection facility. Findings indicated that consistent use of a supervised injection facility was associated with reusing syringes less often, tying off prior to injection, cooking/filtering drugs prior to injection, using clean water for injection, and injecting in a clean place. Furthermore, the study found that use of a supervised injection facility was associated with fewer rushed injections, safer disposal of syringes, fewer outdoor injections, and greater efficacy in finding a vein.

Research has shown that the American public holds low opinions of supervised injection facilities (Barry et al., 2019; McGinty et al., 2018). Furthermore, research has found stereotypes of injection drug users, such as that all injection drug users are dangerous, weak-willed, and steal from people, prevent the public from supporting supervised injection facilities (Bardwell, Scheim, Mitra, and Kerr, 2017; Philbin et al., 2009; Wenger, Arreola, & Kral, 2011). Although the not-in-my-backyard argument could be expected, even general, non-location-specific support

for supervised injection facilities in the United States is low (Barry et al., 2019; McGinty et al., 2018). In this case, research findings suggest that stereotyping partially responsible for low public support for supervised injection facilities, despite the public health benefits.

Current research does not support the stereotypes responsible for hindering public support of supervised injection facilities. For example, research shows that supervised injection facilities have not led to community degradation in areas where they have been implemented. Potier et al. (2014) conducted a systematic literature review of research examining the community risks associated with supervised injection facilities. After reviewing 75 peer-reviewed articles, they found supervised injection facilities were not associated with an increase in drug injecting, drug trafficking, or crime in the surrounding community. Given the positive relationship between empathy and helping behavior (Bagozzi & Moore, 1994; Batson et al., 2002; Clore & Jeffery, 1972; Coke et al., 1987; Small & Verrochi, 2009), people advocating for public support of supervised injection facilities may need to increase empathy toward these marginalized people prior to pushing for a change in public policy.

Unfortunately, research has found that it is difficult to empathize with people who have experiences unlike your own, especially when they are engaging in stigmatized behaviors such as injection drug use (Chung & Slater, 2013). One way overcome this barrier is to increase empathy by priming people to take the perspective of the marginalized group. However, research has demonstrated that people have a more difficult time taking the perspective of drug users compared to other marginalized people (Chung & Slater, 2013).

Here lies the superiority test of virtual reality head-mount displays. Studies have found a positive relationship between presence and emotional arousal, mainly fear or anxiety (Alsina-Jurnet et al., 2011; Bouchard et al., 2008; Price & Anderson, 2007; Riva et al., 2007; Robillard et

al., 2003; Schuemie et al., 2000). Although research is limited, studies have also found a positive correlation between presence and empathy when participants engage in perspective-taking tasks using a virtual-reality head-mount display (Schutte and Stolinovic, 2017; Van Loon et al., 2018). The complexity of this relationship, along with limitations to past research, are covered in more depth in section 2.3. Last, studies have found that some forms of technology (e.g., virtual reality) are better able to produce presence compared to others. Therefore, it's possible that virtual reality could be used as a tool to increase empathy towards people who inject drugs due to the increase in presence people feel when using these technologies.

1.4 Study Purpose

This study has four goals. First, this study tests if virtual-reality head-mount displays produce more presence than less sophisticated virtual-reality technologies (360-degree video) and non-virtual-reality (text narrative with photos displayed on a computer). Second, this study examines how virtual-reality and non-virtual-reality technologies differ in the amount of empathy they arouse in participants engaged in a perspective-taking exercise. Third, this study examines how empathy arousal correlates to public support for a novel public health intervention that has low baseline support and whether certain technology modalities are better at increasing public support. Last, this study explores how different virtual-reality and non-virtual-reality modalities differ in their effectiveness at reducing stereotypes in perspective-taking exercises.

CHAPTER TWO: LITERATURE REVIEW

2.1 Overview of the Literature Review

The literature review is broken into three primary sections. Section 2.2 starts with an overview of research examining the relationship between virtual reality and presence. It discusses conceptualizations of virtual reality and presence as well as common measurements used to evaluate presence. Additionally, this section provides an overview to research that has examined the relationship between presence and emotion arousal.

Section 2.3 conceptualizes empathy and evaluates the best empathy measurement for this study. It also examines on how perspective-taking exercises can be used to increase empathy and provides an overview of research on virtual-reality perspective-taking and its influence on empathy arousal.

Last, section 2.4 provides an overview of research demonstrating the efficacy of supervised injection facilities at reducing risk to people who inject drugs. This section also specifies common stereotypes toward injection drug users and provides evidence for how these stereotypes attribute to low public support for supervised injection facilities. It also explores the relationship between perspective-taking tasks and stereotypes of marginalized groups, including those with mental illness.

2.2 Virtual Reality and Presence

This section starts with a brief overview of virtual reality and its uses in both strategic communications and popular culture. Following, this section clarifies two common terms used to describe similar phenomenon - immersion and physical presence. Last, a review of three

dimensions of physical presence are explored and conceptualized including spatial, perceived realness, and involvement.

2.2.1 Virtual reality conceptualization. Commonly, virtual reality is defined as a computer-generated world or environment (Loomis, Blascovich, & Beall, 1999; Pan and Hamilton, 2018). This definition highlights the idea that “virtual reality is not a *technology*; it is a *destination*” (Biocca, Kim, & Levy, 1995, p. 4). However, this definition by Pan and Hamilton (2018) has been subject to scrutiny for being too simplistic and broad (Slater, 2018). For example, any digital media could meet this definition if it is expansive enough to at least include an environment. What does not fit into this definition would be any non-digital mediated experience, such as a novel or non-digital immersive museum exhibit.

In a critique of this definition, Slater (2018) argues that at minimum the definition should include the idea that virtual reality “perceptually surrounds the participant” (p. 432). With this revision, digital books, movies, and video games would be excluded. The definition does include 360-degree videos and 360-degree games viewed through either a head-mount display system or a computer because these experiences are able to perceptually surround the participant (Slater, 2018).

Slater’s argument that virtual reality is more than just a computer-generated world is not new. For example, Pimentel and Teixeira (1993) suggest virtual reality is a computer-generated experience that is both *interactive* and *immersive*. According to Ryan (1999), “computer generated” simply refers to the characteristics of the data (i.e., it is digital data) and that immersion and interactivity are the key pieces to virtual reality. According to Ryan (1999), being able to feel physically surrounded by the world (immersed) and being able to physically interact with it and even modify it (interactivity) is what drives people to feel a sense of presence during

the experience. This is what makes a virtual-reality experience different than reading a novel or watching a movie. The researcher explores both immersion and presence in more detail in section 2.2.3.

Greengard (2019) uses the same definition as Merriam Webster, which defines virtual reality as “an artificial environment which is experienced through sensory stimuli (such as sights and sounds) provided by a computer and in which one’s actions partially determine what happens in the environment.” The Merriam Webster definition that Greengard (2019) cites aligns with Pimentel and Teixeira (1993), Ryan (1999), and Slater (2018) such that the following components are required for an experience to be considered to be “virtual reality.” First, the experience is digital and experienced through computer technology. Second, users have at least some level of autonomy during the experience to make choices. Third, sensory stimuli are used to facilitate certain perceptions that could include, but is not limited to, sight, sound, touch, and even smell (Greengard, 2019).

One weakness to these definitions is that they do not specify the type or level of autonomy or sensory stimuli to be considered virtual reality. As noted by Slater (2018) the minimum should include the perception of being surrounded by the environment (i.e., 360-degree perspective). From the researcher’s point of view, Slater aligns with popular culture’s expectation of virtual reality. For example, virtual-reality films, also known as virtual-reality storytelling, have become an emerging movement in filmmaking (e.g., the Denver Film Festival has an entire building dedicated to virtual-reality storytelling). These films provide users with a unique 360-degree perspective where they can take the place of a witness to the events occurring throughout the narrative (Dooley, 2017). However, these films rarely evoke additional senses (e.g., smell, touch, or taste) and commonly refrain from giving the user too much autonomy in

the direction of the narrative. Scholars who study virtual-reality storytelling argue that these films are within the definition of virtual reality (Fearghail, Ozcinar, Knorr, & Smolic, 2018).

Although virtual-reality storytelling is an emerging media, there are examples to draw from. “Traveling While Black” was a 2019 Sundance selected film currently available for free in the Oculus store. This film is marketed as a cinematic virtual-reality experience that puts the viewer in a time in history where black Americans were subject to restricted movement. The film received positive reviews from users. For example, one user wrote in the application review, “So well done. Not only did I love the perspective from which most of it was shot – right there, with the story tellers, but the stories & experiences brought me to tears...”.

After reviewing the various definitions and examples of virtual reality, the researcher for this study conceptualizes virtual reality as a digital experience where computer technology provides users with sensory information, and the autonomy to act upon that sensory information. This definition includes 360-degree storytelling films that can be viewed in either a head-mount display or a computer (i.e., desktop virtual reality).

2.2.2 Common Uses of Virtual Reality

Although commonly used for entertainment, virtual-reality has proven to be beneficial in a variety of ways including safety training (McComas, MacKay, & Pivik, 2002), medical training (Dyer, Swartzlander, & Gugliucci, 2018; Gallagher & Cates, 2004; Larsen, 2009), treating phobias (Krijn, Emmelkamp, Olafsson, & Biemond, 2004), and changing attitudes such as implicit bias (Banakou, Hanumanthu, & Slater, 2016; Maister, Sebanz, Knoblich, & Tsakiris, 2013; Peck, Seinfeld, Aglioti, & Slater, 2016) or prejudice toward stigmatized groups (Oh, Bailenson, Weisz, & Zaki, 2016).

Although the adoption of expensive virtual-reality technology, such as the Oculus Rift or HTC Vive, has been slow among the general public (Petty, 2018), the adoption of more affordable virtual-reality systems is increasing. For example, Facebook's Vice President of virtual-reality, Andrew Bosworth, reported that there was \$5 million in content sales within the first two weeks of Facebook's Oculus Quest release in May 2019 (Matney, 2019).

However, desktop virtual reality is even more affordable than head-mount display systems. Commonly uploaded to popular social media platforms such as YouTube or Facebook, 360-degree videos are video recordings that allow users to control the direction of viewing, creating a spherical video experience (Garza, 2015). These videos can be viewed on personal computers and smartphones as well as through head-mounted displays. On a personal computer or smartphone, a user can click, drag, and control the 360-degree view of the video. Users watching a 360-degree video on a computer screen are not physically embedded in the technology. That is, users watching a 360-degree video on a computer screen can still see their keyboard, computer monitor, their hands while they click to control the viewing experience, and interrupting stimuli (e.g., a person walking near where they are sitting). However, users in a head-mount display are embedded in the technology such that they are cut off from the outside "real" environment (i.e., see Figure 1). Furthermore, these users control the 360-degree viewing experience by moving their heads rather than using a keyboard or mouse.



Figure 1

Researcher Wearing an Oculus Go Head-Mount Display

While a person is watching 360-degree videos, a head-mount display (e.g., Oculus Go, Oculus Quest, Sony virtual-reality, etc.) provides two computer-generated images, one for each eye. These images are rendered with “appropriate perspective with respect to the position of each eye in the three-dimensionally described virtual scene” (Slater & Sanchez-Vives, 2016, p.3). The displayed images are mounted in a frame, which is attached to the user’s head. Attaching the frame to the user’s head enables the device to capture the movement of the user’s head in real-time, which then sends a signal back to the device to recompute the images to display the accurate 360-degree view based on where the user is looking (Slater & Sanchez-Vives, 2016). Thus, a head-mount display allows a user to participate with the virtual environment rather than simply view it. This type of technological embedding is often referred to as “immersive technology.” However, scholars commonly interchange immersion and presence, the latter being the focus of this study. The concept of immersion, including the accuracy of its terminology, is explored in more depth below along with the conceptualization of presence.

2.2.3 Differentiating Between Immersion and Presence

2.2.3.1 Immersion conceptualization. The concept of immersion differs from one discipline to the next. Researchers studying virtual reality commonly refer to immersion as the level of technical embedding within a virtual environment (Fromberger, Meyer, Kempf, Jordan, & Muller, 2015; Slater & Sanchez-Vives, 2016). Slater and Sanchez-Vives (2016) argue that an immersive-virtual reality system is one that delivers the ability to replicate natural perceptions and that this ability is entirely determined by the technology rather than the subjective experience of the user. For example, the ability to turn 360-degrees while viewing a continuous update of your view based on the position of your head is a function of the system rather than the subjective experience of the user. Slater and Sanchez-Vives (2016) argue that system A (e.g., head-mount display) is definitively more immersive than system B (e.g., desktop display) without accounting for the subjective experience of the user. This conceptualization of immersion regularly appears in studies assessing the effects of virtual reality in disciplines such as human-computer interaction (Herrera, Bailenson, Weisz, Ogle, & Zaki, 2018; Van Loon, Bailenson, Zaki, Bostick, & Willer, 2018; Steinicke & Bruder, 2014).

According to Mestre, Fuchs, Berthoz, and Vercher (2006), immersion is the primary characteristic that separates virtual reality from other types of technologies. Like Slater and Sanchez-Vives (2016), Mestre et al. (2006) argue that immersion is achieved by removing as many real-world sensations during the virtual-reality experience as possible, so the user is left with the sensations of the virtual environment and feels as if they are present in the virtual environment. Essentially, the more a system can provide users with real-world senses, the more immersive the technology is.

However, not all scholars refer to immersion as an objective technological measurement. For example, scholars studying narratives commonly refer to immersion as the way in which the story, characters, and audience (e.g., reader, viewer, etc.) integrate throughout the experience (Elmezeny, Edenhofer, & Wimmer, 2018). Ryan (2015) highlights four dimensions of immersion including spatial, temporal, spatiotemporal, and emotional immersion. Spatial immersion refers to the narrative setting such as the place and time of the story. Temporal immersion refers the development of the narrative plot, including storytelling structure such as a foreshadowing event (Eschke & Bohne, 2010). Both narrative perspective and the level of viewer integration into the narrative relate to spatiotemporal immersion. Last, emotional immersion is the feeling a story evokes in the audience.

Elmezeny, Edenhofer, and Wimmer (2018) performed a qualitative content analysis on 18 360-degree videos to gain a better understanding how technical immersion and narrative immersion interplay in 360-degree videos and found that both technical and narrative immersion are used to support each other and accomplish goals. For example, technical immersion can use montage, camera movements, and spatial effects to help viewers take on a particular role (narrative temporal immersion) or elicit a feeling (narrative emotional immersion).

2.2.3.2 Presence conceptualization. Although most virtual-reality scholars refer to immersion as an objective measurement, some refer to immersion as a subjective user experience. For example, Witmer and Singer (1998) conceptualize immersion as a physiological experience of losing yourself in a virtual environment and shutting out cues from the outside world. However, according to Slater and Sanchez-Vives (2016), the user's subjective experience of "being there" in the virtual environment, despite knowing they are not, is presence. That is, according to Slater and Sanchez-Vives (2016), presence is the subjective correlate to immersion.

Similarly, Mestre et al. (2006) argue that the purpose of immersion is to instill a belief in the user that he or she is present in the virtual environment. Presence is thus the psychological, perceptual, and cognitive outcome of immersion (Mestre et al., 2006). Therefore, studies that examine the influence of immersion are often interested in the how technological embedding (manipulated by cutting out and replacing real-world sensations with virtual sensations) in a virtual environment impacts the user's sense of being in a simulated situation (Simon & Greitemeyer, 2019). Essentially, these scholars measure how varying the level of technological embedding (e.g., desktop virtual reality vs. head-mount display) impacts the user's subjective experience – as measured by presence.

Presence is commonly distinguished as either physical or social presence. Physical presence refers to a psychological state where the technology user “forgets” they are using technology and perceives the virtual environment as an actual physical space where they behave as if that space was in fact physically real (Felnhofer et al., 2014). Social presence refers to how the technology user perceives virtual others in their interactions (e.g., communicating with a virtual avatar) (Felnhofer et al., 2014). This study is only assessing physical presence and considers social presence to fall outside the scope of this research. Therefore, any mention of presence should be interpreted as meaning physical rather than social presence.

Physical presence can be described as a combination of a user's perceptions of the experience as it relates to spatial senses, environment realness, and user involvement. Spatial presence refers to feeling a sense of being there physically in the virtual environment despite knowing that you are not (Minsky, 1980; Sheridan, 1992). Although real-time sensory perception (e.g., head turning in a head-mount display) can provide a sense of spatial presence (Sanchez-Vives & Slater, 2005), real-time sensory perceptions are not a prerequisite for the subjective

experience of spatial presence. That is, spatial presence can occur even in modalities with less technological embedding. For example, people can experience spatial presence in narratives (Ryan, 2015).

In addition to spatial presence, scholars generally agree that physical presence has two additional components: perceived realness and perceived involvement (Felnhofer et al., 2014; Takatalo, Nyman, & Laaksonen, 2008).

Realness refers to how well the virtual environment is coherent and believable (Felnhofer et al., 2014). According to Slater and Sanchez-Vives (2016), perceived realness is harder to attain and often requires domain knowledge. For example, if doctors are using virtual reality for training purposes, the virtual medical environment must represent the real-world medical environment to the expectations of the doctors. However, the level of domain knowledge that participants are required to have in order to experience perceived realness likely fluctuates based on the context of virtual environment. For example, it is possible to show people a virtual planet Mars environment. Although no person has been to the planet Mars, the researcher argues that people can likely experience some level of perceived realness based on what they already know about Mars from media (i.e., does the virtual Mars environment meet my expectations based on what I know about the planet Mars). Participants in this study will be guided through a virtual medical facility as well as the nearby city environment surrounding the facility (e.g., sidewalk, ally, street, etc.). Therefore, perceptions of how real the virtual environment is are contextualized by their prior experiences in medical facilities (e.g., waiting room, check-in process, etc.).

Involvement refers to the attention that a user devotes to the virtual environment and is often measured as how captivated users feel in the virtual environment compared to the real-world environment (Regenbrecht & Schubert, 2002; Schubert, 2003; Schubert, Friedmann, &

Regenbrecht, 1999; Schubert, Friedmann, & Regenbrecht, 2001). It is important to note that not all scholars consider involvement a dimension of physical presence. Slater (2003) argues that involvement has more to do with content than it does with the technology. For example, you can watch a virtual reality orchestra and feel spatially present but still feel low involvement due to a lack of interest in that type of music. However, the researcher in this study believes that Slater (2003) is referring to content enjoyment rather than content involvement. That is, despite lack of interest in content, a user can still feel captivated in the environment. Consider the sophistication of new virtual-reality technologies. Users can move around freely in the digital space and engage their senses with their surroundings. Regardless of the user's level of interest in the virtual environment, they are demonstrating a level of captivation and attention to the virtual environment rather than the real-world environment that surrounds them. Although this may sound a bit like realness, it is distinct. Realness is about the perceived "accuracy" of the virtual environment. An environment can look and feel real without users being involved in that environment. Similarly, a user can be highly involved in a virtual environment that does not look or feel real (e.g., a popular game with poor graphics). Although involvement should not be the single measure of presence, the researcher in this study acknowledges that certain types of technologies will affect involvement, regardless of content type. Involvement, as measured by a user's level of captivation of the virtual environment rather than to their real-world surroundings is thus one dimension of presence measured in this study.

This study will refer to users' subjective experience of spatial presence, realness, and involvement as physical presence. To avoid confusion, this paper will not refer to technology as more or less immersive. Instead, this study will reference the technological features of virtual-reality systems as differing modalities. Modalities are conceptualized as technology systems that

users interact with via the features afforded by the level of technological embedding (e.g., the size of the human visual field, the “surround” aspects of the sound, etc.). For example, rather than say that participants using the head-mount display are using a more immersive piece of technology, this study will simply state that participants using a head-mount display are using a modality that provides more technological embedding (e.g., the size of the human visual field, the “surround” aspects of the sound, etc.) compared to other modalities being tested in this study, such as a computer screen.

2.2.3.3 Manipulating presence. Research has found that several visual display characteristics affect physical presence, including image quality (Bracken, 2005; Heeter, 1992), image size (Reeves, Detenber, & Steuer, 1993), viewing distance (Biocca & Delaney, 1995, and illusion of depth (Muhlbach, Bocker, & Prussog, 1995). It is important to note that this line of research has slowed since the nineties. However, perhaps due to recent improvements with virtual-reality systems as well as the accessibility of these systems, there has been a recent uptick in virtual-reality research pertaining to presence.

Within this line of research, studies are beginning to once again assess the supposed superiority of these technologies at delivering presence. For example, Seibert and Shafer (2018) found that university students who played a virtual-reality game through a head-mount display experienced more *spatial* presence compared to university students who played the same game on a standard monitor. Wu, Gomes, Fernandes, and Wang (2019) found that participants in an experiment experienced more *physical* presence when the head-tracking feature in head-mount displays was turned on rather than off. In the experiment, participants rode a rollercoaster with a head-mount display and self-reported their level of physical presence.

In another experiment, Shu, Huang, Chang, and Chen (2019) found that head-mount display virtual reality produced greater levels of *spatial* presence compared to desktop virtual reality when participants watched an earthquake education video.

Although the studies to date are few, the literature does suggest that head-mount display virtual-reality systems produce greater presence compared to desktop virtual reality – the evidence is strongest for *spatial* presence, one dimension of physical presence. However, studies have not assessed whether head-mount displays produce higher levels of *physical* presence compared to desktop virtual reality, nor have they examined how text narratives with photographs displayed on a computer screen compare to these two technologies in their ability to produce physical presence. Therefore, this study adds to the literature by including a side-by-side comparison of three media experiences at delivering physical presence. To the researcher's knowledge, a side-by-side comparison of this nature has not been explored.

This study hypothesizes that presence will be higher in the experimental conditions that expose participants to the stimuli using more technological embedding (e.g., illusion of depth, natural navigation, screen size). The head-mount display system tested in this study (i.e., Oculus Go) provides the most technological embedding as it enhances natural movement, creates an illusion of depth, and has the largest screen size, all while blocking or reducing outside environmental cues. The desktop virtual reality has the second most technological embedding, as it allows for user movement using a computer mouse. However, desktop virtual reality does not block or reduce outside environmental cues. Furthermore, movement is less natural compared to the head-mount display condition. The text narrative condition has the least amount of technological embedding as there is no way for users to control the movement of the screen

images, and there is no illusion of depth. Furthermore, the text narrative condition does not block or reduce outside environmental cues. As such, the researcher hypothesizes:

H1A: Presence will be higher in the head-mount display condition compared to the desktop virtual-reality condition.

H1B: Presence will be higher in the head-mount display condition compared to the text narrative condition.

H1C: Presence will be higher in desktop virtual-reality condition compared to the text narrative condition.

2.2.3.4 Presence and emotion arousal

Researchers exploring the relationship between emotion and presence have generally found positive correlations between the two. For example, studies found a positive correlation between presence and fear (Alsina-Jurnet et al., 2011; Bouchard et al., 2008; Price & Anderson, 2007; Riva et al., 2007; Robillard et al., 2003; Schuemie et al., 2000). However, this research is generally limited to virtual-reality exposure therapy for participants with anxiety disorders. For example, Schuemie et al. (2001) examined whether presence was related to anxiety in a clinical sample of 10 patients with acrophobia (fear of heights). Participants were exposed to virtual environments that simulated activities such as riding a roller coaster. Findings indicated a significant positive correlation between presence and anxiety.

Alsina-Jurnet et al. (2011) exposed students to a stressful and non-stressful virtual test-taking simulation environment to examine the relationship between presence and anxiety in participants with high and low levels of test anxiety. Like Schuemie et al. (2001), Alsina-Jurnet et al. (2011) found presence to be correlated with levels of anxiety in both groups of students

when exposed to the stressful test-taking environments. However, the relationship between anxiety and presence was stronger for students with baseline high levels of test-taking anxiety.

Although the correlation between presence and anxiety is clear in the literature, there is significant room for growth in research examining the relationship between presence and emotion. The research to date is incomplete and inconsistent. This is partially due to the confusion around immersion and presence. For example, Visch, Tan, and Molenaar (2010) presented participants with an animated film in a 3D-viewing condition (low technological embedding modality) or a virtual-reality condition (high technological embedding modality) and had them rate their emotions (i.e., funny, sad, fearful, etc.). Instead of measuring presence, Visch et al. (2010) assumed the virtual-reality technology to be more immersive than the 3D viewing condition and did not measure presence to ensure this was the case. Results of the experiment found that participants watching the animated film in the virtual-reality condition experienced stronger emotion arousal regardless of the experienced emotions. However, because Visch et al. (2010) did not measure presence, the study is unable to explain if the increased emotional arousal in the virtual-reality condition the result of an increase of presence.

Although limited, the research that examines the relationship between presence and emotion suggests that the correlation could depend on the type of emotion being measured as well as the strength of the arousal. Baños et al., (2004, 2008, 2012) tested the relationship between presence and emotion arousal on healthy populations. These studies found a positive correlation between presence and sadness in university students (Baños et al., 2004) as well as a positive correlation between presence and relaxation and joy in people aged 55 years and older (Baños et al., 2012). However, Baños et al. (2008) found no relationship between presence and joy and relaxation in a study with university students. In this study, Baños et al. (2008) examined

how manipulating only the illusion of depth when participants explored a virtual park environment affected both presence and the arousal of relaxation and joy. Participants were assigned to a condition with the illusion of depth or without the illusion of depth in either a relaxing or joyful virtual park environment as manipulated by music and movie clips. Despite prior research indicating a positive relationship between illusion of depth and presence, Baños et al. (2008) did not find any relationship between illusion of depth and presence. Baños et al. (2008) suggested that the stimuli of the virtual park environment in the study may be the reason why there was no relationship between illusion of depth and presence as it was designed to induce positive moods (i.e., relaxation and joy). This rationalization was grounded in prior literature suggesting that presence and the illusion of depth are positively correlated when using a neutral-themed stimulus (Hendrix & Barfield, 1996; Freeman, Avons, Davidoff, & Pearson, 1997; Ijsselsteijn, Ridder, Hamberg, Bouwhuis, & Freeman, 1998).

If presence and illusion of depth are correlated when participants are exposed to neutral-themed stimuli, then emotion should not be a prerequisite to experiencing presence. This makes sense as a person in a neutral virtual environment should still be able to feel physically present even if they are not emotionally involved (i.e., angry, sad, etc.). However, being emotionally involved can also have an impact on the way users experience media content. As put by Ijsselsteijn (2003), the technological features of the media modality can impact the way the user experiences the content just as media content, such as the storyline and emotions being communicated, will also impact this experience.

Taken together, these studies suggest that the relationship between presence and emotion arousal is not guaranteed. However, the positive correlation between presence and emotion arousal is more consistent in technologies with more technological embedding and content that

primes certain emotions (e.g., anxiety). Furthermore, the effects resulting from the features of the technological embedding (e.g., illusion of depth, screen size, navigation) may be cumulative such that changes in only one of these features (e.g., illusion of depth) do not increase presence in scenarios where two or three of these features (illusion of depth + screen size + navigation) do increase presence.

2.3 Empathy

As discussed, fear has received most of the attention in research that examines the relationship between presence and emotion arousal. Although research has found clear and consistent correlations between fear arousal and presence, research on the relationship between presence and other emotions has been less consistent. More recently, scholars studying user experiences with virtual reality have shifted to better understand the relationship between presence and empathy arousal. Prior to a thorough review of literature examining the relationship between presence and empathy, the researcher conceptualizes empathy and explores the ways empathy has been studied.

Empathy is a cognitive-affective experience that is conceptualized as the tendency to share and understand another's emotional state (Bagozzi & Moore, 1994). The tendency to empathize is how much a person is inclined to respond with emotions like those of others (Mehrabian, Young, & Sato, 1988).

Empathy differs from sympathy, which is conceptualized as a "response of compassion or concern evoked by the plight of another" (Gruen & Mendelsohn, 1986, p.609). That is, sympathy is a specific emotional state, whereas empathy is a process that in part includes the reproduction of the emotion perceived in another, which can and often does include compassion and/or sympathy (Gruen & Mendelsohn, 1986). The cognitive component of empathy occurs

when a person attributes an emotional state to another person and rationalizes how certain situations relate to that other person (Gopnik & Wellman, 1992). For example, imagine a movie in which a close friend of the protagonist unexpectedly dies of a car crash on a route commonly taken by the protagonist. Shortly after, the protagonist becomes hesitant and fearful of driving that route. The viewer may engage in rationalizing how past events (i.e., close friend dying in a car crash) relates to the protagonist feeling fearful. The viewer may even fantasize about additional scenarios in which the protagonist may feel fearful. The affective component of empathy refers to an emotional arousal that matches the emotional state of another person (Cao, 2013).

2.3.1 Measuring empathy. Some scholars argue that a person does not experience empathy unless they experience both cognitive and affective dimensions of empathy, which require the correct *emotion identification* as well as the correct *intensity identification* of that emotion (Coll et al., 2017). According to this argument, it's possible that a participant in an experiment can successfully identify the target's (i.e., the person to empathize with) emotion (e.g., fear) but misattribute the level of intensity as either higher or lower than what the target feels.

This misattribution leaves room for measurement error when studying empathy because it is possible that participants responding with higher intensity are not necessarily demonstrating more empathy than participants responding with lower intensity (Coll et al., 2017). If the target's emotional state is more representative of lower emotional intensity, then the participants with lower intensity scores would be demonstrating more empathy than participants with the higher intensity scores. This potential measurement error has led scholars to debate the best-fit approach for empathy research, some favoring self-report while others favoring behavioral measures. The

following sections provide a brief overview of behavioral approaches to studying empathy as well as an argument for measuring empathy through self-report.

2.3.1.1 Behavioral and self-report measurements. Numerous behavioral tasks have been used to study empathy including the Picture Viewing Paradigms (Westbury & Neumann, 2008), Comic Strip Task (Vollm et al., 2006), and the Picture Story Stimuli (Nummenmaa, Hirvonen, Parkkola, & Hietanen, 2008). These behavioral measures typically involve showing participants photos and/or narratives and having them select the emotion that corresponds to that being experienced by the target person in the photos and/or narratives. However, the reliability of these behavioral measures is suspect.

First, far fewer studies have used these measures. Second, the researcher of this study sees a variety of issues with using the behavioral measurements. First, participants are still self-reporting their affect in response to the photos and/or narratives, making the behavioral tasks only relevant for the cognitive processes of empathy. Second, the self-report could be subject to priming effects because it takes place directly after participants identify the emotion of the target person in the photo. Therefore, researchers cannot be certain that participants are reporting their actual affect or whether they are simply responding to the affect they were just thinking about that corresponds to the target in the photos.

Coll et al. (2017) suggest measuring empathy with an emotion identification and affect sharing task. Like other behavioral tasks, the purpose of this task is to measure the degree to which a participant in an experiment correctly identifies a target's emotion state and subsequently "feels" that state at an intensity that mimics the target. A high degree of correspondence between the actual intensity of the emotional state of the target and the

empathizer is scored as a high empathic response. This process is called the empathy accuracy task and contains a few important steps, summarized below.

First, people are interviewed and asked to describe an emotional experience while providing a rating of how they felt (emotion type and intensity). These interviews are videotaped and used as stimuli for participants in an experiment where the interviewees are the targets and the participants are the empathizers. This approach allows researchers to compare the target's emotional ratings to the participant's emotional ratings to achieve an accuracy score for participants in terms of correct emotion identification and intensity. For example, Devlin, Zaki, Ong, and Gruber (2016), had participants watch videotapes of interviewees explaining positive and negative life events. The experiences in the tapes ranged between low and high intensity and the interviewees' ratings of their positive and negative events were not shown to the participants. The participants continuously rated how much they thought the interviewee was experiencing positive or negative emotions (i.e., intensity). Additionally, participants reported the type of emotions (e.g., fear, anger, contentment) they thought were displayed in the tapes. Participants who accurately identified the interviewee's emotion and ranked that emotion's intensity accurately were said to demonstrate high empathy.

Although the researcher in this study acknowledges the importance of emotion identification in the empathy process, emotion identification is only one piece of the empathy process, and arguably not the most deserving of attention when studying healthy populations because research suggests healthy people are able to recognize emotions easily (Decety & Meyer, 2008). Additionally, emotion identification does not fully cover the cognitive aspect of empathy, as conceptualized in this study. Again, the cognitive component of empathy occurs when a person attributes an emotional state to another person and *rationalizes how certain*

situations relate to the other person (Gopnik & Wellman, 1992). The empathic accuracy task focuses on having participants identify the emotional state of a target person at a specific time and across one context. However, it does not prime participants to rationalize or fantasize. Furthermore, participants' self-reported emotional intensity is likely to be influenced by having them rate the target's emotional intensity prior to their own. Regardless, the behavioral measurements are unable to sufficiently account for any *rationalizations, fantasizing, or perspective taking* that takes place as part of the empathy process – all of which have been reliably studied using self-report scales such as the Interpersonal Reactivity Index (Davis, 1983).

One way to demonstrate the importance of moving beyond emotion identification is to look at the multi-factorial structure of empathy used in the Interpersonal Reactivity Index (Davis, 1983). Davis (1983) argues that a person who empathizes engages in cognitive and affective processes including perspective taking, fantasizing, empathic concern, and personal distress. Other self-report scales, such as the Feeling and Thinking Scale (Garton & Gringart, 2005) and the Toronto Empathy Questionnaire (Spreng, McKinnon, Mar, & Levine, 2009), include similar dimensions. However, few scales have received as much support as the Interpersonal Reactivity Index, and many scales have been adapted from the Interpersonal Reactivity Index to meet specific needs of populations of interest (e.g., adolescents, people with autism, etc.). To date, most of the empathy research that falls within the context of virtual reality has used the Interpersonal Reactivity Index (Schutte & Stolinovic, 2017; Van Loon et al., 2018).

Regardless of the self-report empathy scale being used, it often focuses on multiple dimensions of empathy, including both cognitive and affective processes. These scales rarely focus on emotion identification. This is partly because research has already identified the

automaticity of emotion identification. For example, Decety and Meyer (2008) suggest that emotion identification is better described as automatic recognition, otherwise known as mimicry.

Decety and Meyer (2008) argue that emotion recognition is an adaptive survival skill that humans learned during evolution. Evidence supports the automaticity of emotion recognition and sharing in humans, starting from an early age (Field, Woodson, Greenberg, & Cohen, 1982; Haviland & Lelwica, 1987). Thus, emotion identification does not encompass the entire process of empathy, but rather focuses on one specific aspect of the process (i.e., can it be done?). This could be why emotion accuracy tasks are typically reserved for studies that assess populations with a disorder that could affect their *ability to empathize* (Blair, 2005; Sucksmith, Allison, Baron-Cohen, Chakrabarti, & Hoekstra, 2013), where the focus is on a population's ability to recognize emotions.

The researcher in this study argues that an “objective” measure of emotional correspondence between the target and the empathizer should not be a prerequisite for empathy in all studies. For instance, if a person reads a book and fantasizes about how he or she would respond if put into the situation of the protagonist, feeling sad or worry for the protagonist when they are subject to harm, then that person is engaged in the empathy process. That is, the person has demonstrated both a cognitive (e.g., perspective taking of the character) and affective (e.g., sharing emotional state of sadness and worry) response to a fictitious scenario. In this example, we cannot guarantee that the fictitious character is feeling sad or worry, because that distinction will always be subjective based on the reader's interpretation. However, this scenario meets the criteria for the conceptualization of empathy.

Unless researchers are dealing with a population that has a relevant disorder (e.g., autism), the objective assessment of emotion correspondence might not be important to the

research questions. Instead, it is the response (i.e., empathic concern, personal distress, etc.) to that cognitive process (i.e., perspective taking, fantasizing, etc.) that is important in most empathy research.

This study examines empathy by priming participants to engage in cognitive processes which should result in participants mirroring the identifiable emotions of a fictitious character. The researcher is using Davis's (1983) Interpersonal Reactivity Index to measure empathy. The four dimensions of the Interpersonal Reactivity Index are outlined in Table 1.

Table 1

Conceptualizations of Each Dimension of the Interpersonal Reactivity Index

Dimension	Conceptualization
Perspective taking (cognitive)	The tendency to take the psychological point of view of others
Fantasy (cognitive)	An individual putting themselves imaginatively into the feelings and actions of fictitious media characters
Empathic concern (affective)	The amount of concern an individual has for others in unfortunate situations
Personal distress (affective)	The amount of anxiety and uneasiness felt in tense situations

This study uses a perspective-taking task to prime the empathy process. The following section provides an overview of perspective-taking research as well as how the dimensions of empathy (i.e., perspective taking, fantasy, personal distress, empathic concern) are affected during perspective-taking.

2.3.2 Perspective-taking exercises. One of the most common ways to study empathy is by having participants engage in a perspective-taking task. These tasks involve having participants imagine what it would be like to be in someone else's situation. These tasks have

been shown to prime individuals to see things from the point of view of a target character or group (Batson, Early, & Salvarani, 1997; Decety & Lamm, 2011). Perspective-taking tasks have also been shown to reduce prejudice and negative stereotyping (Todd, & Galinsky, 2014), increase social bonds, facilitate social interaction (Galinsky, Ku, & Wang, 2005; Krauss & Fussell, 1991), and increase altruistic helping behavior (Cialdini, 1991).

When participants are engaged in perspective taking, they tend to judge others using more situational rather than dispositional factors (Yee & Bailenson, 2006), resulting in a decrease in the fundamental attribution error (Regan & Totten, 1975). Research has found that this occurs as a result of a self-other overlap. For example, Davis, Conklin, Smith, and Luce (1996) found that participants in an experiment rated themselves and another person more similarly on a set of trait words in a perspective-taking condition compared to a control condition. Davis et al. (1996) found that those in the perspective-taking condition felt that they were more like the target character compared to participants in the control condition.

Neuroscience literature has reported that perspective-taking tasks can trigger brain activity that is like the brain activity of the target (Rizzolatti & Craighero, 2004). For example, research suggests that observing another person in a painful situation will trigger similar brain activity in the observer as if the person were actually going through the painful experience themselves (Decety & Ickes, 2009; Singer et al., 2004).

A meta-analysis of these studies found that the overlap in brain response between the self and other is not complete (Jackson, Rainville, & Decety, 2006). This finding makes sense as a complete overlap between the self and the target other would create confusion in the self's motivational response in terms of who needs the helping behavior: the target or the self (Decety & Ickes, 2009). However, research suggests that a larger overlap between the self and the target

other can lead to personal distress (an affective dimension of empathy) (Decety & Ickes, 2009). Although personal distress is a dimension of empathy, according to the Interpersonal Reactivity Index, its effects on prosocial behavior are commonly separate from that of empathic concern. Studies have found that personal distress can motivate individuals to withdraw from the target to reduce the distress, which decreases the likelihood of prosocial behavior (Carrera et al., 2013).

Seeing someone in physical pain is more likely to cause personal distress in the observer compared to seeing someone in emotional pain (Fabi, Weber, & Leuthold, 2019). For example, walking past a homeless person begging for food money could trigger empathic concern and thus helping behavior (e.g., giving a dollar, food, etc.) in the passerby. However, if the homeless person has a broken leg and is crying out, this would likely cause personal distress in the passerby. In some people, rather than be motivated to help, the person could be motivated to withdraw from this situation to reduce personal distress (e.g., cross the street early, avoid eye contact, etc.). Interestingly, studies that have used virtual-reality perspective-taking tasks have largely ignored the personal distress subscale, thus ignoring its effect on any outcomes (e.g., helping behavior). This shortcoming is addressed in greater depth in section 2.5.4, perspective taking in virtual reality.

Research has also explored the effects of fantasy engagement via perspective taking. For example, scholars have noted the potential for people to identify with fictitious characters and think through the fictitious happenings in a movie, video game, or virtual reality environment (Cheetham, Hanggi, & Jancke, 2014; Maccoby and Wilson, 1957; Sheridan, 1992).

The researcher in this study argues that it is essential to include both perspective taking and fantasy subscales when studying how technology facilitates empathy. Where perspective taking encourages people to see things from another's point of view, fantasy pushes this process

forward by continuously engaging people through hypothetical or fictitious scenarios where people are further encouraged to identify with a character. For example, someone engaged in fantasy might think about ways to seek healthcare if they identified as the drug addict in a fictitious story. Similarly, but distinctly different, someone engaged in perspective taking might see things from the point of view of the drug user in the story (e.g., understanding the anger that the drug user feels when they are stereotyped by medical professionals).

Although fantasy has not always been measured in perspective-taking studies, fantasy is commonly measured in studies dealing with technology use. For example, Song, Fiore, and Park (2007) found that participants who experienced more presence during an online shopping experience also experienced more fantasy, such as imagining how they would use the product and how well they could create a mental image of themselves using the product.

2.3.2.1 Perspective taking in virtual reality. The researcher of this study conceptualizes virtual-reality perspective-taking as an experience in which people take the perspective of another person or group within a certain scenario and within a virtual-reality environment. Like traditional perspective-taking exercises, research has found virtual-reality-perspective taking to result in positive effects. For example, virtual-reality-perspective taking can increase helping behavior (Ahn, Le, Bailenson, 2013), reduce implicit bias (Banakou, Hanumanthu, & Slater, 2016; Maister, Sebanz, Knoblich, & Tsakiris, 2013; Peck, Seinfeld, Aglioti, & Slater, 2016), and decrease prejudice (Oh, Bailenson, Weisz, & Zaki, 2016).

Initial studies examining the impacts of virtual-reality-perspective taking have found that certain technological modalities (e.g., head-mount display) are likely to produce greater self-reported empathy compared to other modalities with less technological embedding (Schutte & Stilinovic, 2017). For example, Schutte and Stilinovic (2017) randomly assigned participants to a

2D, non-head-tracking condition or a 360-degree, head-tracking, head-mount display condition and had them watch a short documentary in which they follow a young girl in a refugee camp who shows off her family, makeshift classroom, and other parts of the refugee camp. Results indicated that participants in the head-mount display condition experienced greater perspective taking and empathic concern for the refugee girl compared to participants in the 2D, non-head-tracking condition. Schutte and Stolinovic (2017) also found that engagement (i.e., involvement) acted as a mediator variable between total empathy arousal (measured as perspective taking + empathic concern). However, it is important to note that Schutte and Stolinovic only had 24 participants, indicating that it lacks power. Furthermore, this study used less than half of the original items on the Interpersonal Reactivity Index, eliminating dimensions of fantasy and personal distress. Therefore, the study's total empathy scores did not fully measure the concept of empathy as it is conceptualized in the Interpersonal Reactivity Index. Last, it is important to note that study participants did not "become" the refugee, rather they accompanied the refugee through her experience. That is, the virtual-reality experience did not prime individuals to take the perspective or "act as" the refugee. Rather, participants took the perspective of someone following the refugee.

Although few virtual-reality perspective-taking studies exist, there are a few examples where researchers had participants take the perspective of the empathy target and "act as" the target rather than seeing the target from an outsider's perspective. Van Loon et al. (2018) conducted an experiment where they had university students ($N=180$) participate in a series of virtual-reality games after they had either taken the perspective of their soon-to-be game partner in a "day-in-the-life" simulation or had taken the perspective of a different person in a "day-in-the-life" simulation. Results showed that compared to a control group (i.e., no virtual-reality

perspective taking) participant's subsequent tendency to take the perspective of their game partner was only statistically significantly greater for the participants who had taken the perspective of their soon-to-be partners in the "day-in-the-life" simulation. Participants who first took the perspective of a different person did not show a subsequent tendency to take the perspective of their game partner compared to a control.

Van Loon et al. (2018) also found that for virtual-reality-perspective taking to increase perspective taking for those in the experimental condition where they took the perspective of their soon-to-be partners, it was required that participants feel some level of spatial presence. That is, there was a relationship between spatial presence and perspective taking such that participants only engaged in perspective-taking if they felt spatially present. It is important to note that Van Loon et al. (2018) used a similar subset of the Interpersonal Reactivity Index as Schutte and Stolinovic (2017), measuring perspective-taking and empathic concern but not measuring fantasy or personal distress. Additionally, this study found that virtual-reality-perspective taking was not correlated with any prosocial behavior in the games.

Like Van Loon et al. (2018) and Schutte and Stolinovic (2017), Dyer, Swartzlander, and Gugliucci (2018) explored how virtual-reality perspective taking can be used to evoke empathy. Using a head-mount display, Dyer et al. (2018) put medical students through a virtual-reality simulation where they became a patient with age-related conditions, such as macular degeneration and high-frequency hearing loss. Although the researchers reported an increase in empathy among participants, their study did not report the scale they used, reliability scores, or effects size. However, they did report in their limitations that they need to develop a valid assessment tool to study changes in empathy.

Like this study, Herrera, Bailenson, Weisz, Ogle, and Zaki (2018) exposed participants to one of four conditions to examine how perspective-taking tasks influenced empathy across differing technology modalities. Participants were placed in a condition where they either 1) read statistics and information about homelessness (i.e., control condition); 2) imagined a scenario where they were homeless; 3) watched a 2D video on a computer in which they were primed to take the perspective of a homeless person; or 4) watched a 360-degree video using a head-mount display in which they were primed to take the perspective of a homeless person.

Herrera et al. (2018) found that spatial presence (i.e., one dimension of physical presence) was significantly greater in the head-mount display condition compared to the computer video condition, as assessed by a one-item, open-ended question. Presence was not measured for the control condition or the imagination condition because these conditions did not engage with any technology that placed them in a virtual environment. Herrera et al. (2018) measured self-other overlap and found that all treatment conditions experienced statistically significantly more self-other overlap compared to the control condition. However, there were no significant differences in self-other overlap among the three treatment conditions, suggesting that virtual reality was not any more effective than an imagination exercise at inducing self-other overlap. Similarly, each treatment condition experienced significantly higher empathy scores compared to the control condition, but the treatment conditions did not differ significantly in terms of empathy scores toward the homeless. Interestingly, the study did find that participants in the head-mount display condition were significantly more likely to support prosocial policy aimed at helping the homeless.

The Herrera et al. (2018) study has some limitations. First, the researchers only measured spatial presence, which does not fully encompass the concept of physical presence. Second, the

researchers measured spatial presence using a single open-ended question. Herrera et al. stated that future studies should use a self-report, quantitative scale to measure presence that includes additional dimensions of physical presence rather than just spatial presence. Given these limitations, this study doesn't explain how presence interacts with empathy or public support. Additionally, this study did not assess how reading a perspective-taking narrative differs from other mediated experiences, such as watching a perspective-taking video on a computer monitor or a virtual-reality head-mount display. Rather than have participants imagine a scenario, a more valid study to assess how differing technology modalities affect empathy arousal would be to expose all participants in treatment conditions to the same information, but only vary the modality in which they are exposed to the information.

With prior literature suggesting a positive relationship between presence and emotional arousal it could be that Herrera et al. (2018) did not induce enough presence to see the relationship between presence and empathy. However, it is unclear what the spatial presence scores would be if the researchers had measured it using a validated scale.

To the researcher's knowledge, there is only one study that examines the effects of virtual-reality perspective taking on empathy within the context of mental health. Sri Kalyanaraman et al. (2010) examined how putting participants through both a virtual- reality- perspective taking task and an imagination exercise influenced empathy arousal for people with schizophrenia. They conducted a four-condition, between-subjects experiment in which participants were assigned to one of the following conditions: 1) a virtual-reality (hand-held goggle device) simulation of schizophrenia, 2) an imagination of schizophrenia (i.e., participants were asked to imagine how a person with schizophrenia feels when she or her goes to a drug store and is hearing voices and seeing things that aren't there), 3) a combination of both the

virtual-reality simulation and imagination conditions, or 4) a control condition. Findings indicate that the combined virtual-reality simulation and imagination condition induced greater empathy and positive attitudes toward people with schizophrenia compared to the control or imagination empathy conditions. The virtual-reality-simulation-only condition did not differ significantly from the imagination-only condition, but the mean scores for this condition were significantly higher than the control condition. Additionally, the virtual-reality simulation condition induced greater desire for social distance compared to the imagination-only condition as well as the combined virtual-reality simulation and imagination condition.

Although these results seem promising, there are limitations. First, Sri Kalyanaraman et al. (2010) did not measure presence, making it difficult to use this study to understand the mechanism behind these results (i.e., how did participants process the perspective-taking task in the virtual-reality-simulation exercises that led to an increase in empathy?). Second, it could be argued that the researchers did not measure empathy, but instead that they measured sympathy. The only dimension of empathy included in this study is empathic concern, which is one piece to the affect component of empathy, which measured alone, resembles sympathy.

Using a complete empathy scale for both the affective and cognitive components of empathy should reveal a more complete picture when examining the relationship between the cognitive and affective components of empathy and presence. To date, the literature is sparse and inconsistent in being able to explain the relationship between presence and empathy. However, literature does suggest that presence may need to be high for a relationship to occur with empathy. How each dimension of empathy correlates with presence is still unknown as the researcher's study is the first study to use the full Interpersonal Reactivity Index in its measurements of empathy as it pertains to user experiences with technology. However, piecing

the results from past studies together, the researcher believes that both the cognitive and affective components of empathy should hold a relationship with presence. Therefore, manipulating the technological modalities such that presence increases as the level of technological embedding increases should correlate with greater levels of affect and cognitive empathy.

The first four hypotheses aim to validate the relationship between physical presence and each dimension of empathy. Hypothesis 3A suggests that each experimental condition will have higher empathy score (for each dimension of empathy) compared to the control condition which does not get any perspective-taking exercise. Hypotheses 3B-3E are in line with hypotheses 1A-1C, which predicts which technology modalities will provide the highest physical presence. In hypotheses 3B-3E, conditions with the highest presence are expected to have more empathy (for each dimension of empathy). For hypotheses are as follows:

H2A: Presence will be positively correlated with perspective taking.

H2B: Presence will be positively correlated with fantasy.

H2C: Presence will be positively correlated with personal distress.

H2D: Presence will be positively correlated with empathic concern.

H3A: All experimental conditions will have higher empathy scores compared to the control condition.

H3B: Experimental conditions with higher presence will have higher perspective-taking scores. *(Hypotheses 1A-C suggests the head-mount display will have the greatest presence, followed by the desktop virtual reality, and the text narrative with photos)*

H3C: Experimental conditions with higher presence scores will have higher fantasy scores. (*Hypotheses 1A-C suggests the head-mount display will have the greatest presence, followed by the desktop virtual reality, and the text narrative with photos*)

H3D: Experimental conditions with higher presence scores will have higher personal distress scores. (*Hypotheses 1A-C suggests the head-mount display will have the greatest presence, followed by the desktop virtual reality, and the text narrative with photos*)

H3E: Experimental conditions with higher presence scores will have higher empathic concern scores. (*Hypotheses 1A-C suggests the head-mount display will have the greatest presence, followed by the desktop virtual reality, and the text narrative with photos*)

2.4 Public Support for Supervised Injection Facilities

Although support for supervised injection facilities by people who inject drugs is generally high (Harris, Richardson, Frasso, & Anderson, 2018; Kral et al., 2010), support for supervised injection facilities by the general public is lower. Using a nationally representative sample ($N = 1,004$), McGinty et al. (2018) assessed Americans' support for supervised injection facilities and syringe exchange programs in their communities. Findings indicated that 29% of Americans support supervised injection facilities. Support varied by political affiliation. The survey found that 18.2% [CI: 13.9 – 23.5%] of Republicans, 26.6% [CI: 22.3-31.4] of Independents, and 38.5% [CI: 22.1-44.1] of Democrats support legalizing supervised injection facilities.

Survey participants with higher stigma toward opioid users were less likely to support legalization of supervised injection facilities. In general, the survey found stigmatization of opioid users to be fairly high, with only 15.7% [CI: 13.4-18.2] of American's reporting that they would "probably" or "definitely" be willing to have a person who is using opioids marry into their family and only 27.2% (CI: 24.5-30.2) reporting that they thought people who use opioids were deserving of help.

Barry et al. (2019) identified the most salient arguments supporting and opposing supervised injection facilities in news media, public reports, and advocacy materials. Then they conducted a nationally representative survey of adults ($N = 1,004$) to examine public perceptions of these arguments. Using a five-point Likert scale, participants rated their level of agreement with 10 arguments favoring supervised injection facilities and seven arguments opposing supervised injection facilities. Participants were statistically significantly more likely to agree with arguments opposing the legalization of supervised injection facilities compared to arguments supporting their legalization. The argument most agreed upon by participants against supervised injection facilities was that facilities should be illegal because they would lead to more illegal activities in the neighborhoods where they are located (51%, CI: 47.8-54.2). The argument most agreed upon by participants in support of supervised injection facilities was that supervised injection facilities should be legal because they would reduce HIV and hepatitis C by encouraging safer injection practices, such as using sterile syringes for each injection, among people who use opioids (41.8%, CI: 38.7 – 45).

Despite some members of the public acknowledging the benefits of supervised injection facilities, stereotypes of injection drug users may be preventing additional support. In addition to fear of crime, Barry et al. (2019) found that only 27.3% of survey participants reported that

supervised injection facilities should be legal because they create a space for people who inject drugs to be treated with dignity and respect; only 33.2% reported that supervised injection facilities should be legal because they keep people who inject drugs safe. These findings are consistent across studies examining community support of supervised injection facilities.

Wenger, Arreola, and Kral (2011) examined community stakeholder perceptions of supervised injection facilities in San Francisco's Tenderloin district via in-depth interviews with 20 stakeholders. Stakeholders included neighborhood representatives, business associations, politicians, law enforcement, religious leaders, school officials, community activists, and medical service providers. Although community stakeholders were open to talking about the prospects of a supervised injection facility in the neighborhood, they were largely concerned about potential negative impacts such as neighborhood degradation. For example, a member of the San Francisco Board of Supervisors suggested that a supervised injection facility would increase the number of undesirable people in the community. Other stakeholders were skeptical of how well supervised injection facilities could address opioid use. A service provider stated, "a supervised injection facility would send mixed messages about what we do here. Our recovery program is not a harm reduction model program. It is an abstinence model – you can't be intoxicated when you come here. We have so many people in recovery coming through here we need to be a place they can come and feel safe." (p. 240).

Communities that have implemented supervised injection facilities have measured public perception of supervised injection facilities before and after the supervised injection facilities were implemented. Salmon, Thein, Kimber, Kaldor, and Maher (2007) designed surveys aimed at measuring community experiences and perceptions of a supervised injection facility in Australia. Data was collected prior to the establishment of the supervised injection facility, 18

months into operation, and four and a half years into operation. After four and half years of operation, over 90% of residents ($N = 316$) self-reported at least one advantage to the supervised injection facility located in the area. The most prominently reported advantages include: the control of HIV/AIDS and hepatitis C (22%), reduced risk of overdose (21%), and improved safety for drug users (21%). Approximately 90% of business operators ($N = 210$) also reported at least one advantage to the supervised injection facility, including the control of HIV/AIDS and hepatitis C (17%), reduced risk of overdose (16%), and improved safety for drug users (13%).

Although most residents and business operators could identify advantages to the supervised injection facility, many (78%) could also identify disadvantages. The top three reported disadvantages were that the supervised injection facility encouraged injecting drug use (14%), attracted drug users to the area (14%), and attracted drug dealing (13%). The top three reported disadvantages for this group were that the supervised injection facility did not address the drug problem (11%), encouraged or condoned injecting drug use (15%) and attracted drug users to the area (8%).

The evidence suggests that the public will rationalize both advantages and disadvantages to supervised injection facilities. However, community members typically see supervised injection facilities as an attractant to people who inject drugs, which they desire social distance from. Kolla et al. (2017) ran focus groups with 38 residents and 17 business representatives in Toronto and Ottawa – two large Canadian cities lacking supervised injection facilities. Using thematic analysis, the researchers investigated community perceptions towards the benefits and risks of implementing supervised injection facilities. Findings indicate that community members perceived a supervised injection facility as potentially risk reducing as well as risk enhancing for

their communities. The following paragraphs review the study's findings in detail because these findings are directly relevant to the current study.

Kolla et al. (2017) found that many participants did not trust the credibility of the scientific evidence supporting supervised injection facilities. Furthermore, participants were concerned that there was not enough evidence on the impacts of supervised injection facilities to the community. In addition, participants reported a preference toward implementing additional drug treatment services (e.g., detox, rehabilitation) over supervised injection facilities, with some reporting that money spent on supervised injection facilities was wasted money. For example, a participant in the Ottawa focus group stated:

“It seems wrong to be spending millions of dollars to enable or facilitate the drug habit here, when we’re not providing the way of getting them out of the habit. I’d rather see the money spent on getting them out of the habit, helping them become productive members of society again.” (p. 99).

Participants who preferred investing in treatment services over supervised injection facilities also noted that supervised injection facilities may be helpful as an interim strategy to reduce health risks to individuals prior to entering treatment. Other participants were interested in exploring how supervised injection facilities could push people who inject drugs toward treatment services. For example, a participant in the Ottawa focus group stated:

“One thing that sort of leads me to be more supportive of supervised consumption sites is that it does get them into somewhere where they can talk to people who are healthcare providers, you know, and just as a point of contact, which might lead to a higher success.” (p. 100).

In addition to understanding the role that supervised injection facilities can play in connecting drug users to health services, participants demonstrated awareness that supervised injection facilities will contribute to reduced health risks, such as HIV and hepatitis C, for drug users. Other participants believed that supervised injection facilities could reduce drug users' dependence on emergency services, freeing resources for community members with more "legitimate" emergencies and reducing healthcare costs (Kolla et al., 2017, p. 101).

Residents and business operators raised concerns that a supervised injection facility would create additional risk, such as pushing families out of the community. Other residents were concerned that a supervised injection facility would undo any success the community had made toward addressing drug-related problems. For example, a Toronto resident stated:

"[Neighborhood A] has come a long way in the last 2 years, and it would be a shame to revert it. We had swarms of drug dealers and drug users, and we don't want to go back there again." (p. 102).

According to Kolla et al. (2017), the most common fear mentioned by participants was that a supervised injection facility would act as a magnet for people who inject drugs as well as those who sell drugs. They were also concerned that a supervised injection facility would increase the amount of drug-related litter and disorder, increasing the risk of crime and public nuisance from drug dealing, littering, loitering, and harassment of community members. Community members were particularly concerned with how a supervised injection facility would impact property values. For example, an Ottawa participant stated:

“I don’t know anything about health. But on the business side, property values go down, crime goes up. You have a major problem with everything on the streets. Your own residents are scared.” (p. 104).

2.4.1 Empathy and public support. According to Batson’s and Shaw’s (1991) empathy-altruism hypothesis, empathic concern motivates people to increase another’s welfare. Research has demonstrated a positive link between empathy and attitudes as well as between empathy and helping behavior (Bagozzi & Moore, 1994; Batson, Chang, Orr, & Rowland, 2002; Clore & Jeffery, 1972; Coke et al., 1987; Small & Verrochi, 2009). Furthermore, empathy felt for one group member leads to increased care for the welfare of the entire group if the group member’s identity is a salient component of the context in which empathy was evoked. For example, increasing empathy for a specific person with AIDS or a person who is homeless increased the amount of care for people with AIDS or for people who are homeless (Batson et al., 1997). Furthermore, as empathy is evoked, care towards marginalized groups increases as does helping behavior, such as volunteering (Fultz, Batson, Fortenbach, McCarthy, & Varney, 1986) and donating funds to organizations that support the marginalized group (Batson et al., 2002).

Although the empathic state is short-lived, the effects of empathy on behavior tend to last longer (Batson et al., 1997; Clore & Jeffery, 1972). For example, in an experiment Clore and Jeffery (1972) found that students supported the allocation of funds for disabled students four months after empathy was initially induced.

Although research has identified a correlation between public support and empathy, this research adds to the literature by exploring this relationship in the context of public support for supervised injection facilities – an intervention with low public support among Americans (Barry et al., 2019). Therefore, this research will test the following hypotheses:

H4A: Perspective-taking will be positively correlated with public support for supervised injection facilities.

H4B: Fantasy will be positively correlated with public support for supervised injection facilities.

H4C: Personal distress will be positively correlated with public support for supervised injection facilities.

H4D: Empathic concern will be positively correlated with public support for supervised injection facilities.

H4E: If conditions differ significantly in their empathy scores, those conditions with higher empathy scores will have higher public support scores than will conditions with lower empathy scores.

2.4.2 Stereotypes of injection drug users. A stereotype is an over-generalized belief about a group of people (Cardwell, 1999). These over-generalized beliefs can have serious impacts on marginalized groups when it comes to public policy. For example, common stereotypes of injection drug users, such as they live chaotic lives, are dangerous, weak-willed, and that the problems they face are intrinsically different from the problems non-users face (Ware, Wyatt, & Tugenberg, 2005), can erode public support for interventions to help injection drug users (Bardwell et al., 2017; Barry et al., 2019; McGinty et al., 2018; Philbin et al., 2009; Wenger et al., 2011).

In one study, Bardwell et al. (2017) interviewed community stakeholders (e.g., healthcare, social services, government, law enforcement and emergency services, and business and community sectors) and found that participants representing the business community did not

want supervised injection facilities located downtown because they believed injection drug users would cause community degradation. These attitudes may be driving stereotypes that injection drug users live chaotic lives, steal, and are dangerous.

A similar study by Philbin et al. (2009) explored stakeholder perceptions of the acceptability and feasibility of implementing needle exchange programs, syringe vending machines, and supervised injection facilities in Tijuana, Mexico. Religious stakeholders were largely seen as a barrier to harm-reduction programs by public health professionals, which is consistent with prior research indicating that religious groups perceive harm-reduction models as an approval of risky and immoral behavior (Wynia, 2005). For example, a religious leader stated:

“The only thing a drug user does is to try to find a way to hurt or steal for money and we wouldn’t promote this kind of program.... I believe that sometimes a person has to learn through the consequences of their actions and the problem will not be solved by offering sterilized syringes. Maybe they won’t get HIV or AIDs or other types of illness, right? [But they will continue to use drugs].” (p. 332).

Again, these attitudes may be driving stereotypes that injection drug users are immoral, dangerous, steal from people, and are too irresponsible to appropriately use public health services.

2.4.3 Perspective-taking and stereotypes. Perspective-taking tasks used to evoke empathy have been shown to influence stereotyping. The effect of perspective-taking on stereotypes is thought to be determined by how much self-other overlap occurs during the perspective-taking task such that when participants see more of *themselves* in the target other, they tend to use more self-descriptive traits to describe the target (Davis et al., 1996). This results in less stereotyping

at the individual level (Davis, 1983; Davis et al., 1996) and the group level (Galinsky & Ku, 2004; Galinsky & Moskowitz, 2000). For example, Galinsky & Moskowitz (2000) found that the more that participants saw themselves in the target, the more they also saw themselves in the target's group. This resulted in participants holding fewer stereotypes of the target group.

Most studies have found perspective-taking and stereotypes to be negatively associated with each other (Galinsky & Ku, 2004; Galinsky & Moskowitz, 2000; Johnson, Olivo, Gibson, Reed, & Ashburn-Nardo, 2009). However, there are cases where studies have found perspective-taking and stereotypes to be positively associated with each other. For example, Skorinko and Sinclair (2013) found that the more stereotype-consistent the target person is to the participant in the perspective-taking exercise, the more likely participants are to hold stereotype-consistent attitudes toward the target person. Skorinko and Sinclair (2013) found that participants who took the perspective of a stereotype-consistent elderly or overweight target engaged in more stereotyping compared to participants who took the perspective of a target that was not stereotype-consistent. For example, participants primed with elderly stereotypes (e.g., slow moving) prior to judging the thoughts and feelings of an elderly target tended to stereotype that person more. Skorinko and Sinclair (2013) believe that this occurs because “perspective-takers use the salient stereotypic information as a theory with which to generate the thoughts and feelings of the target” (p. 17). Additional studies support the notion that perspective-taking tasks can increase stereotyping of the target individual (Hodges, Wegner, & Ickes, 1997; Tarrant, Calitri, & Weston, 2012).

Few studies have examined how different technology modalities used in the perspective-taking tasks may affect stereotyping. In one study, Yee and Bailenson (2006) found that a virtual-reality simulation where undergraduate participants were placed in the body of an old

person did not significantly reduce stereotype-consistent attitudes towards the elderly compared to undergraduate participants placed in the body of a young person. However, in a word association task, the researchers found that participants placed in the body of an old person associated traits (e.g., slow, wrinkled) with the elderly as significantly more positive compared to participants placed in the body of a young person. Although Yee and Bailenson (2006) suggest that a virtual-reality head-mount display can be an effective tool at reducing stereotyping, they did not demonstrate its ability to reduce stereotype-consistent attitudes toward the elderly nor did they test whether virtual-reality head-mount displays are more or less effective than other forms of technology. Last, by including an avatar in the study, the researchers arguably didn't harness the power of virtual-reality head-mount displays, which is the novel opportunity to provide users with first-person views into another's surroundings (see Figure 2).

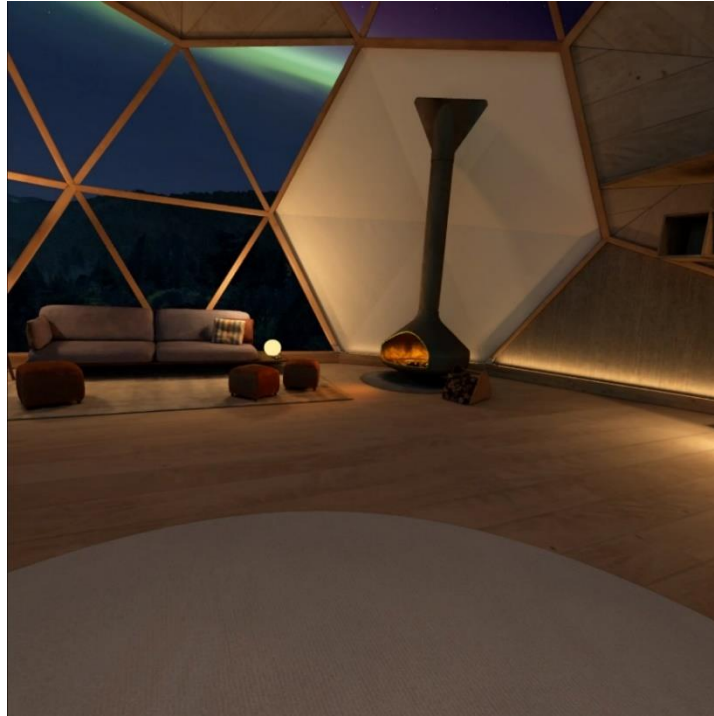


Figure 2

First-person Point of View in Virtual Reality: The Researcher's Virtual Living Room

In another study, Behm-Morawitz, Pennell, and Speno (2016) found virtual racial embodiment in digital gaming led to a reduction in stereotype-consistent beliefs for African American men and greater support for pro-minority policies compared to participants who played a game with a White avatar. However, the researcher sees a few problems when comparing the Behm et al. (2016) study to the current study. First, Behm et al. did not measure perspective-taking. Instead, they assumed that playing the game would prime users to take their avatar's perspective. Second, this study only looks at traditional monitor-based computer gaming and does not speak to the potential benefits of using virtual-reality head-mount displays.

In one of the few studies to examine how virtual-reality perspective-taking affects attitudes towards the mentally ill, Sri Kalyanaraman et al. (2010) examined how a virtual-reality simulator affected participants' attitudes toward people with schizophrenia. The researchers found that a

virtual simulation condition coupled with a written perspective-taking task that had participants imagine a day in the life of a person with schizophrenia produced more positive attitudes towards people with schizophrenia compared to a condition where participants only had the written task or only had the virtual simulation. It is important to note that Sri Kalyanaraman et al. did not use virtual-reality head-mount displays in their study. They used a virtual reality simulator with goggles held over the face, described as a hand-held stereoscope (see Figure 3).

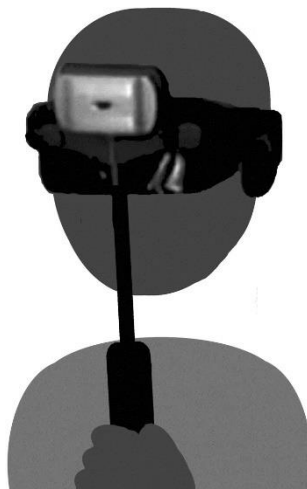


Figure 3

Virtual Reality Simulator Used by Sri Kalyanaraman et al. (2010)

More importantly, Sri Kalyanaraman et al. (2010) measured attitudes rather than stereotypes. For example, using a Likert-scale, they stated, “Our society does not do enough to help people with schizophrenia” and “in general what are your feelings toward people with schizophrenia?” Although it may be a valid approach to examine attitudes, the study does not speak to how the technology affected stereotypes. The study did find that those in the virtual simulation coupled with the perspective-taking day-in-the-life written task had significantly higher scores for desiring social distance from people with schizophrenia. Although the authors were unable to

provide an explanation, it is possible that the virtual simulation and day-in-the-life written perspective-taking task produced additional stereotyping, as seen in prior literature where the target individual was behaving in a stereotype-consistent way (Skorinko & Sinclair, 2013). For example, if participants believed that people with schizophrenia were dangerous, then they may desire social distance. In this case, you can hold favorable attitudes toward people with schizophrenia (e.g., want society to do more to help them) while also holding stereotypes (e.g., people with schizophrenia are uncontrollable), which could result in favorable attitudes toward people with schizophrenia with high desire to socially distance.

This study adds to this body of literature by examining whether virtual-reality head-mount displays are effective at reducing stereotypes compared to other technology modalities, including text narrative with photos and desktop virtual reality. The author of this study does not believe enough research has been conducted to hypothesize. Rather than hypothesize, the researcher prefers to ask a research question in which the results may guide subsequent research.

RQ1: How will stereotypes toward people who inject drugs differ by direction and intensity by condition?

CHAPTER THREE: METHODS

This study is about how different technology modalities influence presence and the potential benefits of increased presence. This study examines the relationship between presence and empathy across three technology modalities: 1) virtual reality head-mount displays, 2) desktop virtual reality, and 3) text narratives with photographs. Additionally, it examines if public support for a novel public health intervention increases when participants engage in a perspective-taking exercise designed to evoke empathy. Last, the study explores whether the benefits of empathy arousal, specifically the reduction of stereotypes toward the marginalized, depend on the technology modality used in the perspective-taking exercise.

3.1 Design

To examine the hypotheses and research questions proposed, this study used a post-test only, between-subjects design with three experimental conditions and one control condition. A post-test only design was selected for two reasons. First, this study is about how different technology modalities influence presence. As such, the researcher is unable to measure presence until the participants have used the technology. Therefore, there is no baseline presence score for pre-test and post-test comparisons. Second, upon extensive research into the concept of empathy, the researcher of this study believes that empathy toward an individual or group is context specific and cannot have a baseline value. Although the tendency to empathize can have a baseline value (Davis, 1983), the act of empathizing with an individual or group is specific to the context that primes the individual to engage in the empathy process. For example, it's not possible to measure baseline perspective-taking toward injection drug users without first providing participants with an opportunity to take the perspective of an injection drug user. The

same can be said for fantasy and personal distress. Although empathic concern can be measured at baseline, obtaining a pre-test score from participants for only one dimension of empathy isn't worth the risk of experimental mortality from pretest to posttest. Furthermore, participants in this study are a homogenous sample of undergraduate students from a single university. As such they are similar in age, education background, geographic location, and race. As seen in 3.5, participant demographics support the use of randomization. Therefore, threats to internal validity are not as big of an issue as they would be if participants were a random sample from a heterogenous population.

Participants were randomly assigned to one of four conditions. All three of the experimental conditions received the same information but the form of the information (i.e., the technology modality used to convey the information) differed by condition. The three experimental conditions engaged in a perspective-taking task to place themselves in the situation of an injection drug user. Participants in the text narrative condition read text accompanied with photographs on a computer monitor. In the desktop virtual-reality condition, participants engaged in the perspective-taking task by watching a video and listening to the narrative with headphones and controlling the direction of view with their mouse to allow for 360-degree viewing. In the head-mount display condition, participants engaged in the perspective-taking task by watching the video and listening to a narrative through a head-mount display virtual reality system (Oculus Go). In the head-mount display condition, participants controlled their viewing angles by moving their heads.

Condition four acted as a control condition; participants in this condition did not engage in the perspective-taking task. However, the control condition participants spent a few minutes imagining what a supervised injection facility would look like, the types of people who would

use one, and what it would look like to see an injection drug user overdose. The researcher designed the control condition this way for two reasons. First, it allowed the researcher to create a benchmark for participants' tendency to empathize with injection drug users without being primed with the perspective-taking task. For example, it allowed the researcher to see how much personal distress participants in the control condition felt when thinking about an injection drug user overdosing compared to how much personal distress participants in the three experimental conditions experienced when they took the perspective of the drug user and overdosed. Similarly, the control group allowed the researcher to compare the tendency to take the perspective of the injection drug user, fantasize about being one, and show empathic concern to the three experimental conditions.

Participants in all conditions received a brief handout prior to the experiment that described the purpose of a supervised injection facility as well as the common arguments for and against supervised injection facilities. The decision was made to give the control condition the handout to ensure they knew enough about the topic to answer the questionnaire. The wording of this handout is available under the stimulus section of the methods (section 3.6.1). Each condition is explained in more depth in the procedures section (section 3.6).

3.2 Power Analysis

Prior studies examining the relationship between virtual reality and emotional/attitudinal outcomes were analyzed to develop a target sample size. For example, Sri Kalyanaraman et al. (2010) had four conditions and ran a series of one-way ANOVAs. While they didn't do a power analysis, they found significance with small effects. Their sample ($N = 112$) was equally distributed and randomly assigned among groups, and effect sizes were small but approaching medium ($\omega^2 = .21$) on group differences for dependent variables measured in this study (e.g.,

empathy). Schutte and Stilinovic (2017) conducted a power analysis using one large effect size ($F = 0.5$), based on a meta-analysis of studies that examined the effects of virtual reality on psychological disorders (Morina et al., 2015) as well as on a meta-analysis of studies investigating the effects of presence on user experiences (Cummings & Bailenson, 2015). Schutte and Stilinovic (2017) determined they needed a sample size of 21 for a two-group comparison.

Given the small-to-medium effect sizes found by Sri Kalyanaraman et al. (2010), this study conservatively estimated effect sizes at medium (.25) rather than large, as done by Schutte and Stilinovic (2017). G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) was used to estimate the required sample size to test for main effects and interactions for this study. An a-priori power analysis determined that a sample size of 180 is needed to achieve power = 0.80 for detecting medium effects as $F = 0.25$ (as classified by G*Power).

3.3 Participants

Undergraduate students aged 18 or older and attending Colorado State University were recruited for participation through classroom visits and email reminders. Students with prior injection drug use history were excluded from participation per IRB requirements. Students were offered extra credit (approximately 1% of total grade in their class) for participation. Students who chose not to participate were given an alternative way to earn the same amount of extra credit. In total, approximately 250 participants signed up for the study. Of the 250 who signed up, 200 completed the study. However, one participant was dropped from analysis due to a malfunction in the technology during the experiment. This participant was still given extra credit, but their responses were deleted from analysis. This leaves a total sample size of 199.

Gender was approximately equally distributed across groups, with each group having fewer males, approximately 16 (± 2) males to 32 (± 2) females. The total count of males and females does not equal the sample size ($N = 199$) because some participants responded that they prefer not to answer ($n = 2$) or gender non-conforming ($n = 1$). There was slight variation of racial diversity across conditions (control = 74% White, text narrative = 84% White, video computer monitor = 89% White, head-mount display = 90% White), but the variation was not significant. Additional descriptive statistics and frequencies describing conditions are presented under the control variables section (section 3.8).

3.4 Procedure

After the brief classroom visit, the researcher sent students a link to the consent form and participation registration. Participants were only given the link to register for the study after the consent form was signed. Once registered for the study, participants were randomly assigned to one of four conditions. Four separate calendars were created with timeslots for participants to register and come to the lab to complete the study. The calendars were created using Pow Wow, a user experience research scheduling software. Each condition had 12, 30-minute timeslots randomly spread out from Monday through Friday. Each timeslot had room for five participants to register before it automatically closed. This left room for 240 participants to register for the study. The researcher tested five participants at a time unless a participant did not show up to their timeslot. In this case, the researcher proceeded with the study with the participants who did show up for the study.

Participants arrived at the lab and were asked to wait outside until their testing time began. This ensured that participants were not introduced to any of the technology while waiting for the study to start. Each session started on time and the door to the room was closed so

participants could not be interrupted by late arrivals. A sign was placed outside of the door for late participants to contact the researcher to reschedule if they missed their appointment.

When participants were let into the lab, the researcher asked them to refrain from using their cellphones and asked them to refrain from socializing for the duration of the study. Participants sat at one of five stations set up with the proper technology depending on the condition in which they were placed.

Participants were presented with an overview on a computer screen on supervised injection facilities (121 words long) to familiarize themselves with supervised injection facilities (see section 3.6.1 for the overview text). Participants were told that they would be answering questions about their experience going through the presentation and that there are no correct or incorrect responses to the survey. They were reminded that if they were being honest, they were completing the survey correctly.

Participants in the three experimental conditions went through a brief demo to practice navigating their presentation and were given a couple minutes to test the equipment by navigating through neutral-themed content. The neutral-themed content was about a digital garden.



Figure 4

Screenshot Example of the Demo Content

Participants in the text-narrative condition practiced moving forward and backward through the presentation, alternating between text and photos of the digital garden. The text described the navigation process. For example, “press the forward arrow on your keyboard to navigate forward.” Participants in the desktop virtual-reality condition practiced navigating the desktop 360-degree navigation using their keyboard mouse. Last, participants in the head-mount display condition practiced navigating with the head-mount display by moving their heads.

The orientation presentation was preloaded and took participants approximately one minute to complete. During this time the researcher left the room. For the three experimental conditions, the experimental stimulus (i.e., supervised injection facility content) perspective-taking task started automatically after the orientation without intervention from the researcher. When participants finished with the perspective-taking task, they used a computer to take the Qualtrics questionnaire. The questionnaire activated once participants clicked a link on a separate tab open on the computer.

In the control condition, participants did not receive any perspective-taking stimulus. Participants read an overview on a computer screen and engaged in two imagination exercises. In the first, they were asked to spend a few minutes imagining what a supervised injection facility would look like and the types of people who would use this service. In the second, they were asked to imagine what it would be like to see someone overdose from injection drug use. The researcher left the room before the imagination exercise began. When participants were finished with the imagination exercises, they used a computer to take the Qualtrics questionnaire. The questionnaire activated once participants clicked a link on a separate tab open on the computer.

For all conditions, participants were instructed to quietly leave the study when they were finished. The researcher intercepted each participant in the hallway to provide them with a debriefing statement. The debriefing statement elaborated on the purpose of the study and informed participants of the mental health services available at Colorado State University and in the Fort Collins area.

3.5. Pilot Test

A pilot test using a student sample ($N = 27$) was conducted prior to the main study. Like the main study, the pilot had three experimental conditions and one control condition. Participants were randomly assigned to one of four conditions. The pilot allowed the researcher to practice the procedure for each group. This included determining the best way to get participants fitted for the head-mount display, the best room configuration for ideal test conditions, the amount of time participants needed to complete each condition, and the number of participants that could be run through each condition at once.

The pilot also allowed the researcher to practice the procedure for interacting with participants in each condition, so the researcher could ensure that participants received the same type of interaction with the researcher, regardless of condition during the main study. In this sense, the goal of the pilot was to determine the best way to create the same experience for every person.

3.5.1 Pilot results. The researcher learned that approximately 25% of participants who registered for the pilot did not show up for the experiment. Therefore, the researcher decided to oversample in the main study to ensure enough participants completed the study to achieve adequate power for data analysis. In the main study, 250 participants registered. However, only 200 completed the study, proving that oversampling was a worthwhile precaution.

During the pilot, the researcher had a few instances where participants were late for their registered timeslot. In these instances, late participants walked into the testing room, which interrupted the flow of the experiment. Therefore, in the main study the researcher decided all late participants would be required to reschedule. In the main study, the researcher placed a sign outside of the testing room door with directions for rescheduling.

Given that there were only 27 participants for the pilot, the researcher did not run any reliability analyses on scales or calculate statistics on the sample. Instead, the researcher combed through the data to ensure there were no input or output errors, commonly skipped questions, skewed responses, or issues with merging the four conditions into one file.

3.6. Stimulus Materials

This study exposes participants in *experimental* conditions to a perspective-taking video produced by the National Film Board (NFB) in Canada. The video titled “Inside Insite” puts

users in the shoes of an injection drug user and walks them through common experiences faced by hardcore injection drug users. The video starts with you (the drug user) outside in a littered alley covered with graffiti. Dramatic music is quietly playing in the background to signal that something bad may happen. People are loitering and walking past you. The people are wearing old, torn clothing and are unkempt. With glares on their faces, they slowly walk past you and eye you up and down. The narrator attempts to draw comparisons between you (the perspective taker) and injection drug users in the video by explaining how people like you do not become addicts on purpose and that the road to addiction can start by taking prescription medicine or after experimenting at house parties. As such, the perspective-taker is primed to see themselves as part of the group (i.e., injection drug users). The narrator explains that it doesn't really matter how you became an injection drug user; what does matter is that you are sick, in real physical pain, and people like you are dying more frequently than those in car accidents.

You look around for a place to fix before going behind a garbage dumpster. The narrator explains that you are not proud of your current situation, but you need to stop the pain. You hide behind the dumpster, which is covered in dirt and graffiti, and you inject heroin. Throughout the experience, the narrator continues to prime the viewer to engage in perspective-taking by emphasizing that the person in the video using injection drugs is "you" and not an "other." After injection, the screen slowly fades to black insinuating that you are experiencing an overdose. The narrator explains something is not right.

The screen slowly turns bright to signal that you are awakening from the overdose. When you wake from the overdose, the narrator is introducing you to a supervised injection facility in Vancouver, Canada. Through the perspective of the injection drug user, the narrator walks you through the supervised injection facility. The narrator explains the check-in process, injection

process, overdose prevention safeguards, available treatment services, and safety measures such as overdose prevention and vein care. The narrator provides the tour as if they are introducing you (i.e., the perspective taker) to these new services for the first time. Again, the narrator is attempting to prime the viewer to see themselves as part of the ingroup (i.e., injection drug users) rather than part of the outgroup (i.e., a non-addict citizen touring a treatment facility). Last, the video guides you outside of the supervised injection facility, where you are among other injection drug users in an impoverished community street. The narrator uses this to serve as a final prime to perspective-taker that they are among the injection drug users (i.e., an ingroup member) as one of them rather than a passerby (i.e., an outgroup member).

The video ends with an acknowledgement that supervised injection facilities are not going to solve the opioid epidemic, but they are part of a holistic public health program aimed at treating addiction in Canada. The video does not explicitly state that it is in favor of supervised injection facilities. However, the narrator positively frames many of the features of the supervised injection facility, indicating that the video is designed in favor of the supervised injection facility. It is important to note that the video also displays negative implications of the supervised injection facility, such as the community degradation surrounding the supervised injection facility.

Depending on experimental condition, the message was shown in one of three formats: video shown through a head-mount display virtual-reality system (Oculus Go), video shown through desktop virtual-reality, or a text narrative and photo presentation on a computer that used Sway software. The information remained constant regardless of the condition. That is, except for the control condition, participants received the same message that put them in the perspective of an injection drug user.

The head-mount display tracked users' head movements so they could see the entire 360-degree shot throughout the entirety of the video. Furthermore, the head-mount display blocked users' peripheral view, forcing out any distracting cues from the experience (see Figure 5). Participants in the head-mount display could not control the speed of the presentation and they used headphones for sound.



Figure 5

Demonstrating how the Oculus Go Blocks Users' Peripheral View (Krales, 2020)

The video shown on desktop virtual reality allowed users to click and drag with a mouse, so they could see an entire 360-degree shot throughout the entirety of the video. Like the head-mount display condition, participants could not control the speed of the presentation and they used headphones for sound. However, desktop virtual reality does not block visual peripheral cues (i.e., participants could see their real-world surroundings).

Last, the text narrative condition used a Sway presentation to display screenshots of images from the video used in the head-mount display and desktop virtual-reality conditions. These photos were presented in combination with the narrative text that corresponded with the photo (see Figure 6). The text narrative condition was purposefully designed to take approximately the same time as the other experimental conditions. The researcher tested the stimuli on five people prior to the pilot and found that the average amount of time people spent on the text narrative was approximately eight and half minutes. Participants in the text-narrative condition did not use headphones because they were reading rather than listening. Like desktop virtual-reality condition, the Sway presentation does not block visual peripheral cues (i.e., participants could see their real-world surroundings).

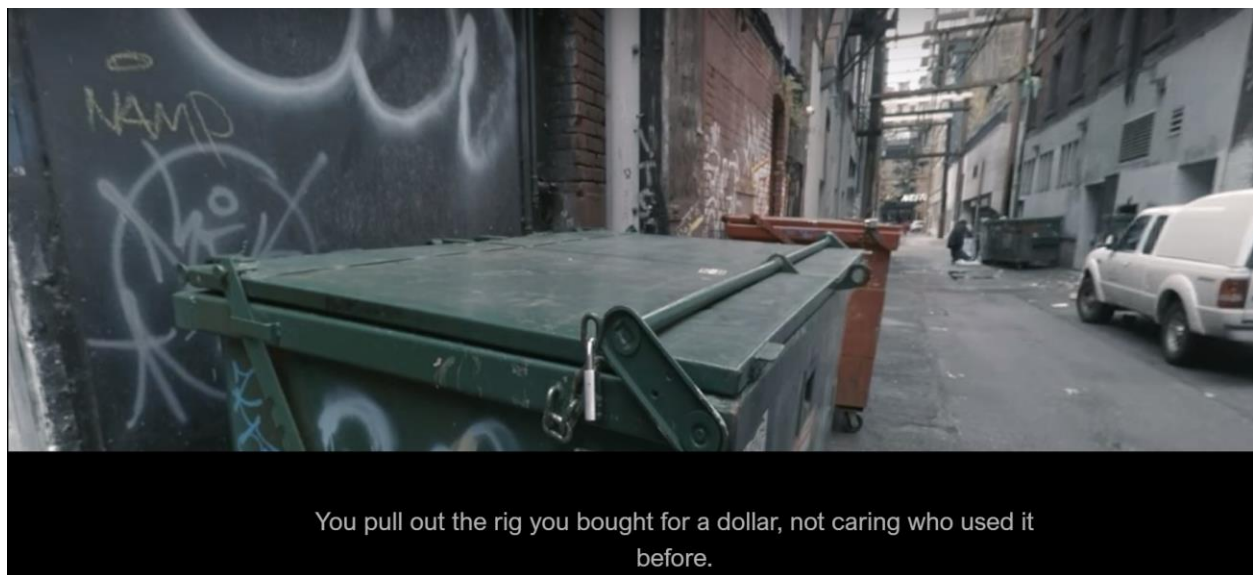


Figure 6

Example screenshot of what participants saw in the text-narrative condition

3.6.1 Informational handout. All participants were given the following information:

“Supervised injection facilities are facilities managed and operated by healthcare professionals that provide high-risk drug users with injecting assistance. These services often include providing drug users with sterile injecting equipment, answering questions on proper vein care, providing education on safer injection methods, offering general health advice, administering first aid, monitoring for overdose, and making referrals to drug treatment and social programs.”

“Supervised injection facilities are currently illegal in the United States. Those against supervised injection facilities suggest that money would be better spend on addiction treatment services rather than services that facilitate the use of illegal drugs. However, those who support supervised injection facilities suggest that they help reduce overdose deaths as well as the spread of HIV and hepatitis C.”

3.7. Dependent variables

Dependent variables were measured in the order in which they occur below.

3.7.1 Presence. Presence was measured first because the questions related to participants’ experience with the modality in which they participated. Therefore, the most accurate measure of this variable occurred directly after participants finished the experience. Presence was measured as a subjective sense of being in a virtual environment using the Igroup Presence Questionnaire (Schubert, Friedmann, & Regenbrecht, 2001). The Igroup Presence Questionnaire was constructed using an initial large pool of survey items and two waves of surveys with approximately 500 participants. It has three subscales, totaling 14 items, that measure place illusion (i.e., spatial presence), plausibility illusion (i.e., experienced realism), and involvement. The subscales were developed via factor analysis with principal component loadings mostly

above 0.6. Internal consistency of the scale was 0.87 assessed by Cronbach's alpha (Schubert, et al., 2001).

Prior to the running the pilot test, the researcher pretested the presence scale on 10 graduate students in the Department of Journalism and Media Communication. This decision was made because the researcher wanted to ensure that the presence scale was not confusing when measuring presence across different technology modalities. The researcher had graduate students go through the perspective-taking task and answer the presence questionnaire. Then each student was debriefed to identify any questions in the presence questionnaire that were confusing or misleading. Multiple students were confused by the repetitive nature of some of the scale questions and felt that it was particularly difficult to answer questions from the involvement subscale. The researcher decided to remove one item from the spatial presence subscale as it was redundant. The item, "I did not feel present" was removed and the item "I felt present" remained. Furthermore, to improve the clarity of the involvement scale, the researcher refrained from broadly referring to the "real world" and instead focused on specific items located in the laboratory. For example, instead of saying "how aware were you of the real-world surroundings while in the virtual world (i.e., sounds, other people, etc.)," the researcher decided to break that item into two separate questions – one referring to how aware participants were of the other people in the room and one referring to how aware participants were of nearby sounds.

All items were measured on a Likert scale from 1 = strongly disagree to 5 = strongly agree. Before calculating scale reliabilities, four items were reverse scaled. Scale reliabilities and mean scores for each of the subscales and the total composite scale are reported in Table 2.

Table 2.

Reliability, Mean, and SD for Presence Subscales and Composite Scale

Scale	α	<i>M</i>	<i>SD</i>
Spatial	.84	3.73	.76
Involvement	.75	3.53	.70
Realness	.64	3.44	.71
Composite	.86	3.59	.58

Each subscale held a Cronbach's α score above 0.70, except for the realism subscale. However, the α score for realness is about the same as it was when the scale was constructed by Schubert et al. (2001), who found an α score of 0.68, suggesting a limitation with the realness subscale rather than this study.

Each subscale was combined, as suggested by Schubert et al. (2001) into a composite presence score. The composite presence scale had a Cronbach's α of 0.86.

3.7.2 Empathy. Empathy was measured using the Interpersonal Reactivity Index scale developed by Davis (1983). As already discussed, past studies examining the relationship between presence and empathy have not used all four dimensions of this scale and typically only use the perspective-taking and empathic concern dimensions. For example, Schutte and Stolinovic (2017) measured empathy induction in virtual-reality-perspective taking after participants were exposed to a head-mount display virtual-reality-perspective taking video of a girl in a refugee camp. Their adjusted eight-item scale only measured perspective taking and empathic concern. The scale did demonstrate an internal consistency of 0.93, as assessed by Cronbach's alpha.

Unlike past research, this study used all four dimensions of the Interpersonal Reactivity Index including perspective taking (five items), fantasy (six items), personal distress (seven items), and empathic concern (seven items). Various studies have warned against using a composite score for the Interpersonal Reactivity Index because the composite score does not accurately capture the difference people have in the cognitive and affective dimensions (Chrysikou & Thompson, 2016; Lucas-Molina, Perez-Albeniz, Ortuno-Sierra, & Fonseca-Pedrero, 2017). All items are measured on a five-point Likert scale (1 = strongly disagree and 5 = strongly agree). The scale reliabilities and mean scores for each of the subscales are reported in Table 3.

Table 3

Reliability, Mean, and Standard Deviation for Empathy Subscales

Scale	α	<i>M</i>	<i>SD</i>
Perspective-taking	.84	3.52	.92
Fantasy	.88	2.8	1.02
Personal distress	.89	2.94	.98
Empathic concern	.83	3.39	.70

3.7.3 Level of support for supervised injection facilities. Level of support was measured using a modified, five-item supervised injection public support scale developed by Strike et al. (2014). Strike et al.'s scale measured public support for a supervised injection facility in Ontario, Canada. For this study, their scale was modified to measure support of supervised injection facilities in Colorado.

Using a five-point scale (1 = strongly disagree to 5 = strongly agree), participants were asked how much they agreed with the following statements: “Supervised injection facilities should be made available to injection drug users in Colorado, to encourage safer drug injection,” “Supervised injection facilities should be made available in Colorado if it can be shown that they reduce overdose deaths or infectious disease among users,” “Supervised injection facilities should be made available in Colorado if they can increase drug users’ contact with health and social workers,” “Supervised injection facilities should be made available in Colorado if it can be shown that they reduce neighborhood problems related to injection drug use,” and “Supervised injection facilities should be legal in Colorado.” The level of support scale was reliable (Cronbach’s $\alpha = 0.90$. Mean scores were high for this scale ($M = 4.10$, $SD = .81$).

3.7.4 Stereotypes toward injection drug users. The researcher was unable to identify a validated scale that measured stereotypes toward injection drug users. Therefore, the researcher made the decision to create a scale that measured this concept. The stereotypes scale is based on prior research identifying common stereotypes for injection drug users. Common stereotypes are that injection drug users live chaotic lives, and that they are weak, immoral, dangerous, irresponsible, unreliable, and unemployable (Ahern, Stuber, & Galea, 2007; Beyrer, Malinowska-Sempruch, Kamarulzaman, & Strathdee, 2010; Natan, Beyil, & Neta, 2009; Ware et al., 2005).

This scales consists of seven items that were measured on a five-point scale (1 = strongly disagree and 5 = strongly agree) including “Injection drug user’s live chaotic lives,” “Injection drug users are immoral,” “Injection drug users are irresponsible,” “Injection drug users are unemployable,” “Injection drug users are weak willed,” and “Injection drug users are

dangerous.” The stereotypes scale had a Cronbach’s alpha score of 0.79. Mean scores for the stereotype scale were above midpoint ($M = 3.12$, $SD = .62$).

3.8 Control variables

The following variables, although not central to the hypotheses in this study, may affect the dependent variables. Therefore, they were measured as a control to ensure they were not responsible for the hypothesized outcome effects.

3.8.1 Participant enjoyment. Enjoyment is conceptualized as positive reactions derived from the stimulus experience (Fang & Zhao, 2010). Some participants may enjoy their stimulus experience more than others. For example, research indicates that higher presence in virtual reality correlates with higher participant enjoyment (Sylaiou, Mania, Karoulis, & White, 2010). If this is the case in this study, the researcher wanted to control for this variance.

Enjoyment was measured using the four-item Van der Heijden (2004) enjoyment scale, which was designed to examine how enjoyment affected acceptance of new technologies. The scale was modified to remain consistent with a five-point Likert scale (1 = strongly disagree to 5 = strongly agree), as used in most measurements for this study. Items include, “The video/presentation was enjoyable,” “The video/presentation was exciting,” “The video/presentation was pleasant,” and “The video/presentation was interesting.”

The scale held a Cronbach’s α of 0.79. Means were above midpoint, ($M = 3.45$, $SD = .74$). Mean scores were consistent across conditions, ($M = 3.6 (\pm 0.1)$, $SD = .65 (\pm 0.1)$), except for the control condition that scored lower on average ($M = 2.87$, $SD = .60$). A one-way ANOVA found significant differences between conditions, $F(3, 195) = 16.96$, $p < .001$. A Tukey post-hoc analysis found that each experimental condition held significantly higher enjoyment scores

compared to the control condition, $p < .001$. The three experimental conditions did not significantly differ.

3.8.2 Past virtual-reality experience. Participants with less virtual-reality experience may go through the perspective-taking exercise differently than those who have prior exposure to these technologies. For example, if participants have never used a head-mount display, they may pay attention to their personal experience rather than focus on the perspective-taking exercise. To ensure this is not responsible for the variance in dependent variables between groups, the researcher measured participants' virtual reality experience.

Participants' past technology experience was measured with two questions. The first question asked participants how much experience they had with head-mount displays (1= I have never used one prior to today to 5 = I use one every day). The next question asked participants how much experience they had with 360-degree videos (1= I have never used one prior to today to 5 = I use one every day).

The mean score for participants' head-mount display experience was low, ($M = 1.60$, $SD = 0.68$). The mean score for participants in the desktop virtual-reality experience was also low, ($M = 1.81$, $SD = 0.53$). Past technology experience was not measured for participants in the text narrative and photo condition because this was not a form of virtual reality.

3.8.3 Political party affiliation. The level of support participants reported for supervised injection facilities could be influenced by their political party affiliation. To control for this, the researcher asked participants "In politics, how would you describe yourself" (1= democrat, 2 = republican, 3 = independent, 4 = something else, 5 = prefer not to answer).

Across conditions, roughly 36.9% participants reported democrat, 18.2% republican, 26.3% independent, 8.6% something else, and 10.1% preferred not to answer. There were slight differences between conditions such that there were approximately 30% democrats in all conditions ($\pm 3\%$), except for the control condition which consisted of approximately 52% democrats. Additionally, conditions contained approximately 15% republican ($\pm 3\%$), except for the text narrative condition which had approximately 25% republican. The text narrative condition was made of approximately 16% independent, the video computer monitor condition was made of approximately 32% independent, the head-mount display condition was made of approximately 34% independent, and the control condition was made of approximately 22% independent.

A Chi-square test was run to see if there were significant differences between groups, $X^2(12, N = 198) = 16.79, p > .05$. The results of the Chi-square found no significant differences in the political party makeup between groups.

3.8.4 Virtual reality sickness. Participants, particularly those in the head-mount display condition, could experience physical symptoms during the simulation that could influence how they responded to the questions in the questionnaire. Participants in the head-mount display condition or video computer monitor condition could experience virtual-reality sickness such as eye strain, headache, or nausea. Research suggests these experiences are common for virtual-reality users (Kuze & Ukai, 2008; Regan & Price, 1994).

The Simulation Sickness Questionnaire (SSQ) is commonly used by researchers to measure self-report virtual-reality sickness (Kongsilp & Dailey, 2017; Lu, 2016). However, research has found that shorter virtual-reality experiences (less than 30 minutes) do not require the SSQ, as many symptoms of virtual-reality sickness measured in the SSQ are unlikely to occur in short

timeframes (Lu, 2016). Prior research has found that the most common symptoms include general discomfort, boredom, nausea, headache, disorientation, and stomach awareness (Kolasinski, 1995). Because the experimental stimuli were substantially shorter than 30 minutes, this study will only measure these common symptoms.

Virtual reality sickness was measured using six items on a five-point scale (1 = strongly disagree to 5 = strongly agree). Sample items include, “I felt nauseous while using the Oculus Go / desktop computer,” and “Using the Oculus Go / desktop computer gave me a headache.” The complete scale can be found in Appendix A.

Virtual-reality sickness was rarely reported ($M = 1.93$, $SD = .86$). Approximately 80% of all participants scored below a 2 on the 5-point scale and only four participants reported at least a 4 on the 5-point scale. Given the low scores, small variability in scores, and few participants reporting any symptoms at all, the researcher decided to remove virtual reality sickness from the analysis.

3.9 Explanatory variables

The literature review revealed numerous variables that may affect the relationships between independent and dependent variables tested in this study. Therefore, the following variables were measured to test how they may interact with the hypothesized relationships.

3.9.1 Mental health diagnosis. Having a past or current mental health diagnosis could have affected how much empathy participants felt toward injection drug users. For example, research has found that people with experiences that are like an empathy target can experience greater empathy toward that target (Hodges, Kiel, Kramer, Veach & Villanueva, 2009). Furthermore, research suggests that people with certain mental health conditions (e.g., depression) may be

more likely to empathize in general (Zhan-Waxler, 2000). Therefore, it was possible that participants with a past or current mental health diagnosis could have experienced greater empathy toward those with addiction issues. To control for this, the researcher included a single question that asked participants if they had ever been diagnosed with a mental health condition by a medical professional (e.g., primary care physician, nurse, etc.). Participants responded with 1 = Yes or 2 = No.

In total, 43 participants (21.72%) said they had been diagnosed with a mental health condition. Each condition had approximately 12 participants (± 1) who reported a mental health diagnosis except for the text narrative condition which had eight participants reporting a mental health diagnosis. A chi-square test revealed that the proportion of participants who had a mental health condition was not significantly different across the four conditions, $X^2(3, N = 199) = 1.78$, $p > .05$.

3.9.2 Drug use history. Participant past or current history of drug use may influence their responses. For example, Batson et al. (1996) found the women who had a similar past upsetting life experience as an adolescent felt greater empathy toward adolescents going through that experience. Although this study excluded participants with prior injection drug use, it's possible that past experience with other drugs could impact the amount of empathy participants had for injection drug users. For example, participants may compare the experiences in the video to their own experiences with drugs, influencing empathy toward injection drug users. Therefore, participants were asked about their drug use history, including alcohol, cannabinoids, benzodiazepines, hallucinogens, speed, barbiturates, and opioids, as suggested by Colorado State University's Assistant Professor of Psychology and Associate Director of Addiction Counseling, Dr. Mark Prince (M. Prince, Personal Communication, September 12, 2019).

Participants were first asked if they had ever used the substance in question (1 = Yes, 2 = No). Those who responded “Yes” were filtered to a subsequent question that asked about their frequency of use within the last month (1 = Never to 5 = Everyday). These two questions were used to create a new variable that ranged from 1 = Never have used the substance to 6 = Uses the substance every day. Participants who scored a 2 on the first question (i.e., have you ever used the substance) were recoded to a 1 and participants who scored a 1 were recoded to a 2. This was done so that those who reported that they had used previously but had not done so in the past month had a drug use history score for that substance that reflected their past use (i.e., 2 rather than a 1).

Generally, drug use scores were low, alcohol ($M = 3.08$, $SD = .99$), benzodiazepines ($M = 1.14$, $SD = .38$), cannabinoids ($M = 2.56$, $SD = 1.40$), opioids ($M = 1.11$, $SD = .35$), speed ($M = 1.23$, $SD = .58$), hallucinogens ($M = 1.35$, $SD = .66$). Barbiturates were removed from analysis as zero participants reported having ever used them. The low drug scores among undergraduate students aligned with the expectations of the Colorado State University’s Director of Addiction Counseling, Mark Prince (M. Prince, Personal Communication, September 12, 2019).

Initially, the researcher planned to use all substances in the analysis. However, upon further reflection, the researcher decided to separate the scores for common legal drugs (i.e., alcohol and cannabinoids) from illegal “hard” drugs (i.e., benzodiazepines, opioids, hallucinogens, speed). This was done because the researcher felt that prior experience using common legal drugs such as alcohol was not a similar experience to injection drug use and therefore should not be used as a measure of drug experience. However, certain hard drug use such as smoking opioids or using speed could be an experience that is partially like injection drug use. Therefore, separating these

scores allowed the researcher to assess how both common legal drug use and illegal hard drug use affected participants' empathy toward injection drug users.

First, the researcher ruled out that common legal drugs (i.e., alcohol and cannabinoids) correlated with empathy toward injection drug users. A correlation analysis revealed that common legal drugs (both alcohol and cannabinoids) did not significantly correlate with any of the empathy dimensions, $p > .05$ and Pearson's r was less than .01 for each.

Using a continuous variable for illegal hard drug use in the analysis was difficult as the mean scores were low, less than 1.5 on a 6-point scale for each drug. This means that most participants had never tried illegal hard drugs. Therefore, the researcher decided to create a dichotomous variable (1 = Yes and 2 = No) to examine whether any past use of hard drugs impacted empathy toward injection drug users.

Using only illegal hard drug use history, 116 participants were categorized as having no illegal hard drug use history, and 83 participants were categorized as having an illegal hard drug use history. Each condition had approximately 22 (± 1) participants who were classified as having hard-drug use history, except for the head-mount display condition, which had 16 participants with hard drug use history. A chi-square test revealed that the proportion of participants with illegal hard-drug use did not differ by condition, $X^2(3, N = 199) = 2.90, p > .05$.

3.9.3 Friend or family member with drug use history (FFDUH). Participants were also asked if they had a family member or close friend with a history of injection drug use as these personal experiences could have affected how much empathy participants felt toward injection drug users. For example, in Davis's (2006) Organizational Model of Empathy-Related Constructs Davis, personal history is included as an antecedent to cognitive processes such as

perspective taking and fantasy. This study included family and close friend drug use history because this life experience could affect how participant empathized with injection drug users. The question was dichotomous (1 = Yes and 2 = No).

In total, 19.70% of participants reported having a family member or close friend with a history of injection drug use. There was more variation across experimental conditions for this variable compared to other control variables (text narrative = 4, desktop virtual reality =14, head-mount display = 12, and control = 9). A chi-square test revealed that the proportion of participants with FFDUH did not differ by condition, $X^2 (3, N= 39) = 6.86, p > .05$.

CHAPTER FOUR: RESULTS

4.1 Explanation of Covariates in Analysis

Political affiliation, past technology experience, and enjoyment were treated as potential covariates in the analysis. As such, political affiliation, past technology experience, and enjoyment were checked to see whether the magnitude of the effect size was at least .25 when tested with independent and dependent variables related to the hypotheses (i.e., presence, the empathy subscales, public support, and stereotypes). The researcher decided on the .25 threshold because the analysis would not have held enough power if all covariates were included (according to the power analysis conducted using G Power). Therefore, the researcher decided to only include variables that met the .25 threshold. A t-test was used to check whether the effect size of political affiliation held a magnitude of .25 or higher across independent variables. The t-tests revealed that political affiliation held an effect size less than .25 and therefore political affiliation was excluded as a covariate in subsequent analyses.

Past technology experience held Pearson's correlation coefficients below .25 for all independent variables and therefore was excluded as a covariate in subsequent analyses.

Enjoyment held Pearson's correlation coefficients at or about .25 for presence, perspective taking, and fantasy. Therefore, enjoyment was treated as a covariate when testing these variables in subsequent analyses to ensure that enjoyment was not responsible for any hypothesized variance between conditions.

4.2 Presence

The first set of hypotheses predicted that the experimental condition in which participants went through the perspective-taking exercise would influence the amount of presence

participants experienced during the task. These hypotheses exclude the control condition because participants in the control condition did not receive treatment in which presence would be evoked. The first three hypotheses are as follows:

H1A: Presence will be higher in the head-mount display condition compared to the desktop virtual-reality condition.

H1B: Presence will be higher in the head-mount display condition compared to the text narrative condition.

H1C: Presence will be higher in desktop virtual-reality condition compared to the text narrative condition.

To test these hypotheses, the researcher ran a one-way ANOVA to compare presence means between conditions. A homogeneity of variance test was used to check the assumption for running an ANOVA. Levene's Test must yield p values above 0.05 to pass the assumption. Levene's Test yielded significance values above 0.05 for the mean, median, and adjusted medians values. Outliers were checked using casewise diagnostics. Two outliers were identified. The outliers were checked to ensure they were genuine outliers and kept in for data analysis.

There was a statistically significant difference between groups as determined by the one-way ANOVA, $F(2, 150) = 5.93, p < .01$, partial $\eta^2 = .07$. A Tukey post-hoc test revealed that the amount of presence participants experienced was significantly higher for participants in the head-mount display condition ($M = 3.81, SD = .54$) compared to the video computer monitor condition ($M = 3.52, SD = .51, p < .01$) and the text narrative condition ($M = 3.45, SD = .64, p < .001$). Although presence was higher for the desktop virtual-reality condition ($M = 3.52, SD = .51$) compared to the text narrative condition ($M = 3.45, SD = .64$), these means did not differ

significantly, $p = .80$. The results of the ANOVA and post-hoc Tukey test support hypotheses 1A and 1B but fail to support 1C. Table 4 shows the multiple comparisons with 95% confidence intervals adjusted using Bonferroni.

Table 4

Comparison of presence between conditions

Condition (I)	Condition (J)	Mean difference	SE	CI:LB	CI: UB
HMD	TN	.37**	.11	.09	.64
	DVR	.30*	.11	.02	.57
DVR	TN	.070	.11	-.20	.34
	HMD	-.296*	.11	-.57	-.02

$p < .01^{**}$, $p < .05^{*}$, Text narrative (TN), Desktop virtual reality (DVR), Head-mount display (HMD), Standard error (SE), Confidence intervals (CI:LB, CI:UB)

4.3 Empathy and Presence

The second set of hypotheses predict that presence will be positively related to each dimension of empathy. The hypotheses are as follows:

H2A: Presence will be positively correlated with perspective taking.

H2B: Presence will be positively correlated with fantasy.

H2C: Presence will be positively correlated with personal distress.

H2D: Presence will be positively correlated with empathic concern.

To test these hypotheses, a bivariate Pearson correlation was performed across all conditions. Prior to running Pearson's correlation, statistical assumptions were checked. There

were no outliers in the data, as assessed by inspection of a boxplot for values greater than 1.5 box-lengths from the edge of the box. Homoscedasticity was determined from the visual inspection of a scatterplot. Table 5 presents the correlation matrix between presence and each dimension of empathy as well as the correlations between each dimension of empathy.

Table 5

Correlation Matrix Between Presence and Each Empathy Dimension

Measure	Presence	Perspective-taking	Fantasy	Personal distress	Empathic concern
Presence	-				
Perspective-taking	.276**	-			
Fantasy	.728**	.448**	-		
Personal distress	.316**	.386**	.500**	-	
Empathic concern	.099	.347**	.267**	.160*	-

** Correlation is significant at the .01 level

* Correlation is significant at the .05 level

The results of test support hypotheses H2A through H2C. However, the test failed to find a main effect between presence and empathic concern. As discussed in section 3.9, numerous personal experiences can influence empathic concern (see Batson et al., 1996). Therefore, the following variables were tested to examine their impact on the relationship between presence and empathic concern: mental health diagnosis, having a close friend or family member with a history of injection drug use, and personal history with illegal hard drug use.

4.3.1 Mental health diagnosis. Participants with a past or current mental health diagnosis could show more empathic concern for people who inject drugs compared to participants without a past or current mental health diagnosis (see section 3.9). Therefore, it is

possible that the correlation between presence and empathic concern is moderated by whether the participant had any personal experience with mental illness.

To examine this possibility, the researcher ran a linear regression to examine whether presence interacted with mental health diagnosis to affect empathic concern. Prior to running the linear regression, assumptions were checked. There was independence of residuals, as assessed by a Durbin-Watson statistic of 2.03. Outliers were checked using casewise diagnostics and one outlier (± 3) standard deviations was identified. The regression analysis was run both with the outlier removed and with the outlier in the data analysis. Because there was not a major difference in the significance value of the model when the outlier was removed compared to when the outlier was kept in the data, the researcher kept the data point in the analysis. There was homoscedasticity, as assessed by visual inspection of a plot of standardized residuals versus standardized predicted values. Residuals were normally distributed as assessed by visual inspection of a normal probability plot, meeting statistical assumptions to continue with the analysis.

Presence and past mental health diagnosis (non-interaction) were entered in the first step of the regression analysis. In the second step of the regression analysis, the interaction between past mental health diagnosis and presence was entered. Model 2 explained a significant increase in variance in empathic concern, $\Delta R^2 = .04$, $F(3, 146) = 5.82$, $p < .05$. Thus, past mental health diagnosis was a significant moderator of the correlation between presence and empathic concern. The unstandardized coefficient for participants with a mental health diagnosis is .60, $p < .01$ and the unstandardized coefficient for participants without a mental health diagnosis is .01, $p > .05$. The results of the test suggest that the relationship between presence and empathic concern exists

for those with a mental health diagnosis but does not exist for those who do not have a mental health diagnosis. These findings lend partial support for hypothesis 2D.

4.3.2 Friend or family member with drug use history (FFDUH). Having a close friend or family member with injection drug use experience could also impact the relationship between presence and empathic concern as these life experiences can be antecedents to empathy (Davis, 2006). Therefore, how presence affects empathic concern could be moderated by whether a person has a close friend or family member with injection drug use history.

The researcher ran a linear regression to examine whether presence interacted with FFDUH to affect empathic concern. Prior to running the linear regression, assumptions were checked. There was independence of residuals, as assessed by a Durbin-Watson statistic of 2.02. Outliers were checked using casewise diagnostics and no outliers were identified. There was homoscedasticity, as assessed by visual inspection of a plot of standardized residuals versus standardized predicted values. Residuals were normally distributed as assessed by visual inspection of a normal probability plot, meeting statistical assumptions to continue with the analysis.

Presence and FFDUH (non-interaction) were entered in the first step of the regression analysis. In the second step of the regression analysis, the interaction term between past FFDUH and presence was entered. The change in R^2 from model 1 to model 2 was not significant, $\Delta R^2 = 0.0, p > .05$. The results do not suggest that FFDUH moderated the relationship between presence and empathic concern.

4.3.3 Drug use history. Participants' experiences with illegal hard drugs could have affected the relationship between presence and empathic concern such that those who had taken

hard drugs could be more empathic toward injection drug users compared to those who had no experience with hard drugs (see section 3.9). Therefore, it is possible that the correlation between presence and empathic concern was moderated by whether the participant had experience with hard drugs.

To examine this possibility, the researcher ran a linear regression to examine whether presence interacted with hard drug use to affect empathic concern. Prior to running the linear regression, assumptions were checked. There was independence of residuals, as assessed by a Durbin-Watson statistic of 1.88. Outliers were checked using casewise diagnostics and one outlier (± 3) standard deviations was identified. The regression analysis was run both with the outlier removed and with the outlier in the data analysis. Because there was not a major difference in the significance value of the model when the outlier was removed compared to when the outlier was kept in the data, the researcher kept the data point in the analysis. There was homoscedasticity, as assessed by visual inspection of a plot of standardized residuals versus standardized predicted values. Residuals were normally distributed as assessed by visual inspection of a normal probability plot, meeting statistical assumptions to continue with the analysis.

Presence and drug use history (non-interaction) were entered in the first step of the regression analysis. In the second step of the regression analysis, the interaction term between drug use history and presence was entered. Model 2 did not explain a significant increase in variance in empathic concern, Δ adjusted $R^2 = .02$, $F(1, 147) = 2.31$, $p > .05$. Thus, hard drug use history was not a significant moderator of the relationship between presence and empathic concern.

4.4 Empathy Between Conditions

The researcher's hypotheses were correct that there would be a statistically significant positive correlation between presence and empathy (presence and empathic concern was moderated by mental health diagnosis). Furthermore, there was a relationship between presence and condition. Therefore, it is hypothesized that conditions with higher presence (i.e., head-mount display) will have higher cognitive and affect empathy scores. Additionally, it was hypothesized that each experimental condition will have higher empathy scores compared to the control condition.

Multiple studies warn against using the Interpersonal Reactivity Index as a composite empathy score; instead, they recommend using four separate subscales (i.e., perspective taking, fantasy, personal distress, and empathic concern) (Chrysikou & Thompson, 2016; Lucas-Molina, Perez-Albeniz, Ortuno-Sierra, & Fonseca-Pedrero, 2017). Therefore, each dimension of empathy was tested independently, so the researcher could examine the differences between cognitive and affect empathy. The control condition was kept in the analysis to examine whether the experimental conditions receiving a perspective-taking task had higher empathy scores compared to a baseline empathy score. The hypotheses are as follows:

Hypotheses 3A: Across all dimensions of empathy, experimental conditions will have higher empathy scores compared to the control condition.

H3B: Experimental conditions with higher presence scores will have higher perspective-taking scores.

H3C: Experimental conditions with higher presence scores will have higher fantasy scores.

H3D: Experimental conditions with higher presence scores will have higher personal distress scores.

H3E: Experimental conditions with higher presence scores will have higher empathic concern scores.

4.4.1 Perspective taking. Enjoyment was treated as a covariate in the relationship between presence and perspective taking. Therefore, a one-way ANCOVA was conducted to determine whether there was a statistically significant difference between conditions on perspective taking while controlling for enjoyment. Prior to running the test, statistical assumptions were checked. Casewise diagnostics identified two outliers in the data. The researcher decided to leave them in the analysis as the results of the ANCOVA did not differ significantly when they were removed. Perspective-taking scores were approximately normally distributed for each condition, as assessed by visual inspection of their histograms. A homogeneity of variance test was used to check the assumption for running an ANCOVA. Levene's Test yielded significance values above .05 for the mean, median, and adjusted medians values.

Test results showed that there was a significant effect of condition on perspective taking after controlling for enjoyment, $F(3, 194) = 6.27, p < .001$, partial $\eta^2 = .09$. A Tukey post-hoc test revealed that the amount of perspective taking participants engaged in was significantly higher for participants in the head-mount display condition ($M = 3.6, SD = .87$) compared to the control condition ($M = 2.9, SD = .84, p < .001$). However, participants' perspective-taking scores did not differ significantly between the head-mount display condition and the desktop virtual-reality condition ($M = 3.78, SD = .89, p > .05$) or the text narrative condition ($M = 3.73, SD = .86, p > .05$). The results of the analysis support hypothesis 3A but fail to support hypothesis 3B.

4.4.2 Fantasy. Enjoyment was treated as a covariate in the relationship between presence and fantasy. Therefore, a one-way ANCOVA was conducted to determine whether there is a statistically significant difference between conditions on fantasy while controlling for enjoyment. There were no outliers in the data, as assessed by inspection of a boxplot for values greater than 1.5 box-lengths from the edge of the box. When testing for normality, the CWWS score was normally distributed for the text narrative, video computer monitor, and head-mount display conditions as assessed by Shapiro-Wilk's test ($p > .05$). The control group violated the assumption. The researcher decided to move forward with the test as the one-way ANOVA is "robust" to deviations from normality, especially if the sample sizes between groups are approximately equal as is the case in this study (Lix et al., 1996). Furthermore, Maxwell and Delaney (2004) report that non-normality does not affect the Type I error rate substantially when running an ANOVA. A homogeneity of variance test was used to check the assumption for running an ANOVA. Levene's Test yielded significance values above .05 for the mean, median, and adjusted medians values.

The results of the test found that there was a significant effect of condition on fantasy after controlling for enjoyment, $F(3, 194) = 7.86, p < .001$, partial $\eta^2 = .11$. A Tukey post-hoc test revealed that the amount of fantasy participants engaged in was significantly higher for participants in the head-mount display condition ($M = 3.03, SD = 1.02$) compared to the control condition ($M = 2.08, SD = .83, p < .001$). However, participants' fantasy scores did not differ significantly between the head-mount display condition compared to the desktop virtual-reality condition ($M = 2.91, SD = .98, p > .05$) or the text narrative condition ($M = 3.15, SD = .91, p > .05$). The results of the analysis support hypothesis 3A but fail to support hypothesis 3C.

4.4.3 Personal distress. To test the hypotheses that personal distress would differ by condition, the researcher started with a one-way ANOVA to examine main effects. There were no outliers in the data, as assessed by inspection of a boxplot for values greater than 1.5 box-lengths from the edge of the box. When testing for normality, the CWWS score was normally distributed for all conditions as assessed by Shapiro-Wilk's test ($p > .05$). A homogeneity of variance test was used to check the assumption for running an ANOVA. Levene's Test yielded significance values above .05 for the mean, median, and adjusted medians values.

There was not a statistically significant difference between groups as determined by one-way ANOVA $F(3, 191) = .411, p > .05$, partial $\eta^2 = .01$. Therefore, instead of conducting a post-hoc analysis, mean scores and standard deviations are reported: text narrative condition ($M = 2.95, SD = .92$), desktop virtual-reality condition ($M = 2.95, SD = 1.00$), head-mount display condition ($M = 3.04, SD = .94$), and control condition ($M = 2.81, SD = 1.10$). The results of the analysis fail to support hypothesis 3A as well as hypothesis 3D.

4.4.4 Empathic concern. To test the hypotheses that empathic concern would differ by condition, the researcher started with a one-way ANOVA to examine main effects. When testing for normality, the CWWS scores were not normally distributed for the head-mount display condition or the computer monitor condition as assessed by Shapiro-Wilk's test. Data transformation was used to correct for moderately negatively skewed data. This resulted in CWWS scores being corrected for the head-mount display condition. The desktop virtual-reality condition CWWS scores improved from $p = .004$ to $p = .05$, passing the threshold ($p = .05$). The data transformation also reduced an extreme outlier. Extreme outliers are outliers that are more than three times the height of the box in the boxplot. An ANOVA was run with the transformed data as well as with the normal data to examine how the transformation impacted the results.

With the non-transformed data, a homogeneity of variance test was used to check the assumption for running an ANOVA. Levene's Test demonstrated that the data distribution passes the assumption. The relationship between empathic concern and condition was not significant, as determined by one-way ANOVA $F(3, 192) = 1.502, p > .05$. With the transformed data, a homogeneity of variance test was used to check the assumption for running an ANOVA. Levene's Test passed the assumption. Again, the relationship between empathic concern and condition was not significant, as determined by the one-way ANOVA $F(3, 192) = 1.516, p > .05$. Given that the equations produced from the transformed data are nearly identical to the non-transformed data, the researcher made the decision to proceed with the original data. As there were no main effects, the researcher did not run post-hoc analyses. Therefore, mean scores and standard deviations are reported: text narrative condition ($M = 3.51, SD = .72$), desktop virtual-reality condition ($M = 3.40, SD = .71$), head-mount display condition ($M = 3.41, SD = .61$), and control condition ($M = 3.39, SD = .70$).

4.4.4.1 Mental health diagnosis. Mental health diagnosis affected the relationship between presence and empathic concern. Therefore, the researcher examined whether mental health diagnosis affected the relationship between condition (because presence differs by condition) and empathic concern.

A two-way ANCOVA was conducted to determine whether mental health diagnosis affected the relationship between condition and empathic concern. The interaction effect between condition and mental health diagnosis on empathic concern was not significant, $F(3, 188) = 1.74, p > .05$, partial $\eta^2 = .03$. A pairwise comparison showed that participants with a mental health diagnosis ($M = 3.54, SE = .11$) did not differ significantly from participants without a mental

health diagnosis ($M = 3.33$, $SE = .06$), $p > .05$. The results of the analysis do not support hypotheses 3A or 3D.

4.5 Public Support

The next set of hypotheses predicted that all dimensions of empathy will be positively correlated with public support for supervised injection facilities. The hypotheses are as follows:

H4A: Perspective-taking will be positively correlated with public support for supervised injection facilities.

H4B: Fantasy will be positively correlated with public support for supervised injection facilities.

H4C: Personal distress will be positively correlated with public support for supervised injection facilities.

H4D: Empathic concern will be positively correlated with public support for supervised injection facilities.

H4E: If conditions differ significantly between empathy scores; those with higher empathy scores will have the higher public support scores.

To test these hypotheses, a bivariate Pearson correlation was performed across all variables. Prior to running the Pearson correlation, statistical assumptions were checked. There were no outliers in the data, as assessed by inspection of a boxplot for values greater than 1.5 box-lengths from the edge of the box. Homoscedasticity was determined from the visual inspection of a scatterplot. Table 6 presents the correlation matrix between public support and each dimension of empathy as well as the correlations between each dimension of empathy.

Table 6*Correlation Matrix Between Public Support and Each Empathy Dimension*

Measure	Public support	Perspective-taking	Fantasy	Personal distress	Empathic concern
Public support	-				
Perspective-taking	.276**	-			
Fantasy	.140*	.728**	-		
Personal distress	.055	.386**	.500**	-	
Empathic concern	.310**	.347**	.267**	.160*	-

** Correlation is significant at the .01 level

* Correlation is significant at the .05 level

The results of the Pearson correlation found that each dimension of empathy was positively correlated to public support, except for personal distress. The relationship between personal distress and public support was not significant, $p < .05$. The results of the analysis support hypotheses 4A, 4B, and 4D, and fail to support hypothesis 4C.

Hypothesis 4E was not tested as there were no statistically significant differences in empathy between conditions, as suggested by the results of hypotheses 3A-3E. This relationship was a prerequisite to testing hypothesis 4E. Without an increase in empathy between conditions, the researcher cannot examine whether an increase in public support between conditions would be a result of an increase in empathy between conditions. Table 7 reports the means and standard deviations for public support of supervised injection facilities for each condition.

Table 7*Means and SD of public support of supervised injection facilities*

Condition	<i>M</i>	<i>SD</i>
HMD	4.01	.87
DVR	4.18	.75
TN	4.10	.86
Control	4.02	.75

Text narrative (TN), Desktop virtual reality (DVR), Head-mount display (HMD)

4.6 Stereotypes

Most research suggests that perspective-taking tasks reduce stereotypes. However, some research has found that participants engaged in perspective-taking tasks hold higher stereotypes compared to control conditions. Furthermore, research to date has not explored whether the technology modality affects stereotypes. Yee and Bailenson (2006) suggest that virtual reality could be a more effective way to reduce stereotypes against the marginalized, but few studies have been conducted to support this position. The research question explores how stereotypes of people who inject drugs will differ between condition.

RQ1: How will stereotypes toward people who inject drugs differ by condition?

To examine if conditions hold higher or lower stereotyping scores, the researcher started with a one-way ANOVA to examine main effects. When testing for normality, the CWWS scores were normally distributed for all condition as assessed by Shapiro-Wilk's test ($p > .05$). Four outliers were identified and confirmed to ensure they were genuine. The researcher decided to leave them in the analysis as the results of the ANOVA did not differ significantly when they were removed. A homogeneity of variance test was used to check the assumption for running an

ANOVA. Levene's Test yielded significance values above .05 for the mean, median, and adjusted medians values.

There was a statistically significant difference between groups as determined by the one-way ANOVA, $F(3, 194) = 3.60, p < .05$. A Tukey post-hoc test revealed that stereotype-consistent beliefs about injection drug users were significantly higher for participants in the control condition ($M = 3.35, SD = .90$) compared to the text narrative condition ($M = 3.08, SD = .09, p < .05$) and the desktop virtual-reality condition ($M = 2.99, SD = .08, p < .01$) but not the head-mount display condition ($M = 3.27, SD = .09, p > .05$).

CHAPTER FIVE: DISCUSSION

5.1 Overview of the Study

Research has found that physical presence is correlated with the arousal of certain emotions. Most of the research has focused on fear and anxiety (Alsina-Jurnet et al., 2011; Bouchard et al., 2008; Price & Anderson, 2007; Riva et al., 2007; Robillard et al., 2003; Schuemie et al., 2000). These effects have been consistent in studies assessing the impact of physical presence on fear and anxiety when participants view stimuli through a virtual-reality head-mount display. However, substantial gaps occur in the literature concerning the relationship between physical presence and other emotions such as empathy. Although some studies have found that virtual reality can increase presence, which is then correlated with empathy arousal, these studies have limitations and do not evaluate the efficacy of virtual-reality head-mount displays compared to desktop virtual reality and text narratives with photographs displayed on a computer.

The few studies to examine the relationship between physical presence and empathy using virtual reality employ a modified version of the interpersonal reactivity index to measure empathy arousal. However, these studies do not use the entire interpersonal reactivity index (Schutte & Stolinovic, 2017; Sri Kalyanaraman et al., 2010; Van Loon et al., 2018), which leaves gaps in how the studies are measuring cognitive and affect empathy. Commonly, these studies remove the fantasy (cognitive) and personal distress (affect) dimensions and focus on a modified version of perspective taking and empathic concern. This is a shortfall as both fantasy and personal distress are dimensions of empathy (Davis, 1983) that have been shown to correlate with presence (Alsina-Jurnet et al., 2011; Sas & O'Hare, 2003; Song et al., 2007). Thus, this

study focuses on a more comprehensive examination of the relationship between presence and empathy, measuring perspective taking, fantasy, empathic concern, and personal distress.

Other than a handful of studies (Herrera et al., 2018; Shu et al., 2019), the superiority of virtual reality at evoking empathy compared to more traditional media experiences (e.g., watching a video or reading a narrative) has not been tested. Rather, studies tend to focus on whether virtual reality can increase empathy via virtual-reality perspective taking. Although some studies have found virtual reality to be an effective means to increase empathy (Schutte & Stilinovic, 2017; Sri Kalyanaraman et al., 2010; Van Loon et al., 2018), the causal relationship between presence and empathy is still unclear as is the benefit of using virtual-reality head-mount displays compared to more traditional technologies. It is also unclear whether virtual reality is superior to more traditional forms of media in the degree to which participants experience the benefits of empathy arousal (i.e., increase in public support and decrease in stereotypes) during perspective-taking exercises.

The primary purpose of this study was to examine whether virtual reality was superior at evoking physical presence and empathy compared to more traditional media experiences. This purpose was accomplished in three ways. First, this study tested the assumption that virtual-reality head-mount displays produce more physical presence compared to desktop virtual reality and text narratives with photographs on a computer. Although some studies have found virtual-reality head-mount displays to effectively produce physical presence, to the researcher's knowledge, few have tested their superiority against desktop virtual reality and text narratives. Second, this study addressed a crucial weakness found in prior research, which is that the few studies that have examined how virtual reality evokes empathy do not comprehensively measure empathy or presence. Therefore, this study compared the superiority of virtual reality head-

mount displays at empathy induction (via presence) compared to desktop virtual reality and text narratives by measuring perspective taking, fantasy, empathic concern, and personal distress. Third, this study examined how the effects of empathy arousal, such as increased public support for a novel public health intervention and a decrease in stereotypes of injection drug users, differed by the technology modality.

To examine these relationships, the researcher manipulated the amount of physical presence participants experienced during a perspective-taking exercise. Physical presence was manipulated through the use of differing technology modalities as prior research has found that technologies offering the illusion of depth and realistic navigation – features that virtual-reality head-mount displays have more of compared to desktop virtual reality and text narratives (Muhlbach et al., 1995) – produce greater presence. By doing so, the researcher examined the effect of presence on empathy. This also allowed the author to make comparisons between conditions regarding how much empathy was aroused as well as the amount of public support participants held for supervised injection facilities and the degree to which participants believed common stereotypes about people who inject drugs.

To test the hypotheses that physical presence would differ by condition, participants in the three experimental conditions engaged in a perspective-taking exercise that placed them in the role of an injection drug user walking through a supervised injection facility after overdosing. Control-condition participants did not engage in a perspective-taking exercise. Participants in the experimental conditions self-reported the amount of physical presence they experienced after the perspective-taking exercise, and the researcher compared the amount of physical presence experienced between conditions (head-mount display, desktop virtual reality, and text narrative). The results indicated that physical presence was higher in the virtual-reality head-mount display

condition compared to the desktop virtual-reality condition and the text narrative condition. However, the desktop virtual-reality condition and the text narrative condition did not differ significantly, $p > .05$.

To test the second goal of this study, the researcher examined if there was a positive correlation between physical presence and perspective-taking, fantasy, personal distress, and empathy across experimental conditions. As the researcher hypothesized, the results indicated that presence was positively correlated with perspective taking, fantasy, and personal distress across experimental conditions. However, the relationship between presence and empathic concern, was moderated by participants' mental health status across experimental conditions.

The researcher proceeded to address the second goal of this study by comparing perspective-taking, fantasy, personal distress, and empathic concern between conditions. The hypothesis was that conditions with higher physical presence would have higher perspective-taking, fantasy, personal distress, and empathic concern. Although there was a positive correlation between physical presence and each dimension of empathy, and participants in the head-mount display condition experienced more physical presence compared to the text-narrative and desktop virtual-reality conditions, participants in the head-mount display condition did not display significantly more cognitive or affect empathy compared to the text-narrative or desktop virtual-reality conditions. However, each experimental condition had significantly greater levels of cognitive empathy (perspective taking and fantasy) compared to the control condition.

The third goal of this study was to examine if the effects of empathy arousal differed by condition. On average, participants across conditions had high scores for public support for supervised injection facilities and low scores for beliefs in stereotypes of injection drug users. Although public support did not differ between conditions, there was a positive relationship

between public support and perspective taking, fantasy, and empathic concern. Last, the virtual-reality head-mount display condition was the only experimental condition that did not significantly lower stereotypes toward people who inject drugs compared to the control condition.

5.2 Implications of Results

5.2.1 The relationship between the technology modality and physical presence. The results from this study support the hypothesis that virtual-reality perspective taking with head-mount displays produces significantly more physical presence compared to desktop virtual reality and text narratives with photographs on a computer. However, the effects are small. For example, the mean physical presence score for participants in the head-mount display condition was 3.84, whereas the mean physical presence score for participants in the desktop virtual-reality condition was 3.52, and those in the text narrative held a mean score of 3.45. Although few studies have taken a comparative approach to studying physical presence, these findings support research to date that virtual-reality head-mount displays produce greater presence compared to text narratives and desktop virtual reality (Herrera et al., 2018; Selzer, Gazcon, Larrea, 2019).

Herrera et al. (2018) found desktop virtual reality produced more presence than text narratives, which this study did not find. This finding is likely due to the different approaches used to measure physical presence. As Herrera et al. (2018) report in their limitations, physical presence should be measured with a multidimensional scale rather than with a single, open-ended question about the extent to which participants felt spatially present. Specifically, Herrera et al. (2018) asked participants to explain how *spatially* present they felt, and then the researchers coded the answers from -1 (low presence) to 1 (high presence). This study took the advice of Herrera et al. (2018) by including a multidimensional measure of physical presence that extended

beyond spatial presence to include both involvement and perceived realness, for a more comprehensive measure of *physical* presence. Thus, it is possible that desktop virtual reality does not offer an advantage in all dimensions of presence (spatial, involvement, realness) but perhaps offers an advantage to a specific dimension of presence (i.e., spatial). To examine how spatial presence differed between conditions, the researcher ran a one-way ANOVA to examine differences in spatial presence scores by condition.

There was a statistically significant difference between groups as determined by the one-way ANOVA, $F(2, 150) = 11.36, p < .001$, partial $\eta^2 = .12$. A Tukey post-hoc test revealed that the amount of spatial presence participants experienced was significantly higher for participants in the head-mount display condition ($M = 4.09, SD = .68$) compared to the desktop virtual-reality condition ($M = 3.71, SD = .58, p < .05$) and the text narrative condition ($M = 3.41, SD = .84, p < .01$). Spatial presence was not significantly higher in the desktop virtual reality condition compared to the text narrative condition at the .05 level, $p = .09$. Again, the differences between this study and Herrera et al. (2018) could be due to differences in how the two studies measured spatial presence, a single open-ended response (Herrera et al., 2018) compared to the five-item scale used in this study.

The fact that this study found conditions to differ significantly in physical presence suggests that virtual-reality head-mount displays may have a small advantage at delivering physical presence. Research should continue to explore ways users interact with the virtual world to get a better understanding of how physical presence incrementally changes with advancing technology. For example, according to Greengard (2019), virtual reality is advancing through the use of haptics. Haptics refer to digital technologies aimed at producing a replication of real-world senses (Greengard, 2019). For example, nerve endings in the skin send information to our

brains, such as feeling heat when you touch a hot coffee mug. These sensations help humans understand how to behave, such as waiting for coffee to cool before picking it up again. Thus, a successful haptics system aimed at mimicking hand movement would need to replicate human hand movement to allow for a virtual-reality user to press, grab, pinch, squeeze, and even stroke objects. Additionally, the system needs to replicate two types of responses to convince your brain that you are touching something real: 1) the basic sense of contact with an object, and 2) the sense of motion along with pressure (Greengard, 2019). Through haptics, researchers have even explored the possibility of replicating the sense of smell by using oils and chemicals that can be activated by pressure (Munyan, Neer, Beidel, & Jentsch, 2016). For example, Stanford University's Virtual Human Interaction Lab created a virtual doughnut that both looks and smells real (Metz, 2017). As these technologies advance, researchers should investigate their ability to increase physical presence in virtual-reality applications.

5.2.2 The relationship between presence and empathy. The findings from this study replicate research suggesting a positive correlation between empathy and presence (Schutte & Stolinovic, 2017; Van Loon et al., 2018). In addition, this study addresses limitations in these past studies. Schutte and Stolinovic (2017) found involvement (a single dimension of physical presence) to mediate the relationship between experimental condition and empathic concern, suggesting a more comprehensive exploration between presence and empathy is warranted. Van Loon et al. (2018) found presence to mediate the relationship between perspective-taking and empathic concern, again suggesting presence plays a role in how people experience empathic concern during perspective-taking exercises. Furthermore, studies by Van Loon et al. (2018), Schutte and Stolinovic (2017), and Sri Kalyanaraman et al. (2010) do not measure fantasy or personal distress, two dimensions of empathy. To the researcher's knowledge, this study is the

most comprehensive exploration of the relationship between presence and empathy arousal given that it includes a multidimensional presence scale as well as the multidimensional empathy scale to measure the four dimensions of empathy, i.e., perspective-taking, fantasy, personal distress, and empathic concern.

As hypothesized, results from the correlation analysis found that across conditions physical presence was positively correlated with perspective taking ($r = .28$), fantasy ($r = .73$), and personal distress ($r = .32$). As mentioned, Van Loon et al. (2018) found presence to mediate the relationship between perspective-taking and empathic concern; thus the positive correlation between presence and perspective taking found in this study aligns with past research. Prior to this study, research has not explored the relationship between fantasy and presence via perspective-taking exercises. However, Song et al. (2007) found presence and fantasy to be positively correlated in a study of online shopping behavior. Song et al. (2007) found that participants who experienced more presence during an online shopping experience also experienced more fantasy, such as imagining how they would use the product. The positive correlation between fantasy and presence found in this study aligns with Song et al. (2007) and provides support that presence and fantasy are positively correlated across new contexts.

This study looked at the relationship between physical presence and personal distress. Prior research has found a positive correlation between anxiety or fear and presence (Alsina-Jurnet et al., 2011; Bouchard et al., 2008; Price & Anderson, 2007; Riva et al., 2007; Robillard et al., 2003; Schuemie et al., 2000). In line with these studies, this research found a positive correlation between physical presence and personal distress, which conceptually is similar to anxiety and fear (Davis, 1983). Thus, the positive correlation between physical presence and personal distress found in this study could be explained by the fact that personal distress closely

resembles anxiety and fear. This study adds to the literature by documenting a case in which presence is positively correlated with personal distress.

This study found the relationship between presence and empathic concern to be conditional such that only participants with a past or current mental health diagnosis experienced an increase in empathic concern as presence increased. To parse out the moderation effect, the researcher revisited the methodology and findings from prior studies and found that an initial day-in-the-life imagination task, if given prior to perspective-taking exercises, has been effective at evoking more empathic concern compared to only engaging in one or the other (i.e., either day-in-the-life imagination or perspective-taking exercise). The researcher believes this could be a result of two primes, each engaging different dimensions of cognitive empathy, resulting in an overall increase in empathic concern.

In one example of the two-primed approach, Sri Kalyanaraman et al. (2010) found that a virtual-reality simulation perspective-taking exercise was not any better at increasing empathic concern compared to an imagination perspective-taking exercise. However, when participants in the virtual-reality simulation perspective-taking exercise went through an imagination exercise prior to going into the virtual-reality simulation, then their empathic concern was higher compared to participants in the imagination-only exercise condition. Participants in the virtual-reality simulation with two primes were first primed to imagine themselves in a “day in the life” scenario of the empathy target group (i.e., people with schizophrenia). After, they took part in a perspective-taking virtual-reality simulation where they were primed for a second time to take the perspective of a person with schizophrenia. In this instance, participants were first primed to *fantasize* what it would be like to be part of the group (people with schizophrenia) and then

primed to take the *perspective* of a person in a virtual environment who had schizophrenia (i.e., they became the character).

Research suggests that people who perceive themselves as part of the target group are more inclined to have empathic concern for an empathy target, such as someone with a mental illness, compared to someone who does not view themselves as part of the group (McKeever, 2012). Participants who experienced an increase in empathic concern in both Sri Kalyanaraman et al. (2010) and Van Loon et al. (2018) were first given an initial opportunity to fantasize about being a part of the in-group prior to the perspective-taking exercise. For example, Van Loon et al. (2018) had participants look at their digital selves in the mirror prior to unpacking their college suitcase for the first time in their dorm room. According to Van Loon et al. (2018), this was done to elicit body transfer in participants. Following, participants engaged in a series of college-related perspective-taking tasks such as public speaking.

The results of Sri Kalyanaraman et al. (2010) and Van Loon et al. (2018) could be explained by how participants couple the primes to engage in the empathy process. The first task (i.e., day-in-the-life imagination scenario) primes participants to fantasize about being part of the in-group. The second perspective-taking task (e.g., virtual-reality perspective taking) primes participants to empathize with the target individual in the group.

In this study, participants were not given the initial opportunity to identify as an in-group member through a day-in-the-life scenario. This could be why the results of this study did not find any differences in empathic concern between the control condition and the experimental conditions. Essentially, this study was asking participants how much empathic concern was felt toward a member of their out-group. However, participants with a mental health condition were a notable exception to the rule. It is possible that participants with a mental health condition saw

themselves as part of the in-group while engaged in the perspective-taking exercise. Rusch et al. (2009) examined the relationship between perceptions of group identity with people with mental illness and resiliency to stigma. Rusch et al. (2009) recruited participants with a variety of mental health conditions (e.g., depression, bi-polar, psychotic disorders, and drug and alcohol disorders) to examine how their identification with the group of people with mental illnesses affected their resiliency to stigma and willingness to help others with mental illness. Rusch et al. (2009) found a positive correlation between identification with the group and beliefs that people with mental illnesses form a meaningful group. Furthermore, group identification was negatively correlated with discrimination toward people with mental illness and positively correlated with intentions to help others who have a mental illness. Results by Rusch et al. (2009) suggest that people with mental illness identify as part of a group despite having differing diagnoses between members. Additionally, the study demonstrates that identifying as part of the group is associated with various intentions to help group members and be resilient against discrimination.

Based on the findings from Rusch et al. (2009), the moderating role of mental health diagnosis found in this study falls in line with past research. Essentially, it is possible that participants with a mental health diagnosis felt as if they were part of the ingroup (i.e., people with mental illness). In turn, the relationship between presence and empathic concern was moderated by mental health condition because people with mental health conditions felt more empathic concern. However, the proposed series of relationships suggests that empathic concern increased presence rather than presence increasing empathic concern.

Examining this moderation effect further requires the researcher to revisit the correlation between presence and empathy. Although the researcher in this study was interested to see how incremental increases in presence could affect empathic concern, other scholars have studied

how baseline empathic concern correlates to presence. For example, Sas and O'Hare (2003) found that participants' tendency towards empathic concern correlated with their feelings of physical presence when going through a desktop virtual-reality experience that mimicked different rooms in a building, such as a conference room, training room, library, and lobby.

Based on the research on the relationship between perspective-taking and empathic concern as well as the relationship between presence and empathic concern, the researcher offers the following response to why the relationship between presence and empathic concern was moderated by participants' mental health status. First, as aligned with prior research by Sri Kalyanaraman et al. (2010), this study found that participants did not experience an increase in empathic concern from a virtual-reality perspective-taking exercise. It's possible that including a day-in-the-life imagination exercise prior to the perspective-taking exercise could have resulted in a statistically significant difference between the experimental conditions and the control condition. Although the researcher can't be certain, it's possible that a day-in-the-life imagination exercise would have primed participants to fantasize about becoming the in-group prior to the perspective-taking exercise which could have increased empathic concern, as seen by Sri Kalyanaraman et al. (2010). Second, research suggests that people with any particular mental health condition view themselves as part of a larger group of people with mental health conditions (Rusch et al., 2009). Thus, the fact that people with a mental health condition held higher empathic concern towards injection drug users makes sense. Third, research suggests that people with more empathic concern have an easier time experiencing higher levels of physical presence (Sas & O'Hare, 2003). Therefore, it is possible that presence does not increase empathic concern, but empathic concern increases physical presence. As such, it doesn't matter which condition participants are placed in (high versus low presence); instead, whether they

experience increased empathic concern will depend on how they perceive themselves as members of the group under question (i.e., are they in group or out group members). Under this rationalization, it makes sense that in the present study, conditions did not differ in their empathic concern scores, because higher presence is not going to increase empathic concern. However, when participants saw themselves as in-group members (i.e., participants with a mental health diagnosis seeing themselves as part of the same group as drug addicts), they had higher empathic concern scores, and a significant and stronger relationship emerged between physical presence and empathic concern because empathic concern is causing an increase in physical presence.

Studies should continue to untangle this effect by comparing how participants with prior relevant history differ compared to participants without prior relevant history as well as participants without prior relevant history who are primed by a day-in-the-life scenario prior to a perspective-taking exercise.

5.2.3 The benefits of the technology modality on empathy. The hypotheses in this study stated that greater physical presence would be correlated with greater empathy and that certain technology modalities (i.e., virtual-reality head-mount display > desktop virtual reality > text narratives and photographs shown on a computer) would be superior at inducing physical presence, thus would be superior at inducing empathy. Although the study found a positive correlation between physical presence and each dimension of empathy (empathic concern was moderated by mental health diagnosis) and the study found that virtual-reality head-mount displays produced significantly greater physical presence compared to the desktop virtual-reality condition and the text narrative condition, the results failed to support the hypothesis that certain technology modalities would evoke greater amounts of empathy than others during perspective-

taking. Furthermore, cognitive empathy (perspective taking and fantasy) differed between the control condition and each experimental condition. However, affect empathy (personal distress and empathic concern) did not differ between the control condition and each experimental condition. Based on these findings, the researcher believes there are differences in how physical presence interacts with the cognitive dimensions (perspective taking and fantasy) and the affect dimensions (personal distress and empathic concern) of empathy.

5.2.3.1 Affect empathy and physical presence. It is plausible that certain emotions, such as empathic concern and personal distress, increase presence rather than the other way around. A closer look at the studies that tested the correlation between anxiety and presence lends support to the idea that personal distress (similar to anxiety) is responsible for increasing presence, but presence may not always be responsible for increasing personal distress. For example, Schuemie et al. (2010) found a positive correlation between fear and presence. Schuemie et al. (2001) examined whether presence was correlated to anxiety in a clinical sample of patients with acrophobia (fear of heights). Schuemie et al. (2010) exposed participants to a virtual environment that simulated activities associated with heights, such as riding a roller coaster. Findings indicated a significant positive correlation between presence and fear. However, to the researcher's point, Schuemie et al. (2010) found this relationship by having a group of participants with acrophobia (fear of heights) go through a virtual-reality simulation involving heights. Essentially, the participants already had a high baseline fear of heights. Thus, it is likely that the correlation between presence and fear was a result of the emotion arousal that participants felt during the experience.

Results from Alsina-Jurnet et al. (2011) also support the idea that personal distress increased presence. Alsina-Jurnet et al. (2011) exposed students to a stressful or non-stressful

virtual test-taking simulation to examine the relationship between presence and anxiety in participants with high and low levels of test anxiety. The results also support a positive correlation between anxiety and presence. However, the relationship between anxiety and presence was stronger for students with high baseline levels of test-taking anxiety. Again, these results suggest that the anxiety was causing the increase in presence.

When examining the possibility that personal distress increased physical presence, this study aligns with research from Alsina-Jurnet et al. (2011) and Schuemie et al. (2010). Thus, the researcher believes this study adds to the literature by aligning with prior evidence suggesting that a person's feelings toward the content used to prime perspective taking is going to influence anxiety arousal which will then impact physical presence. A follow-up study should aim to manipulate the amount of personal distress participants feel during an experience and examine how much physical presence each participant experiences.

5.2.3.2 Cognitive empathy and physical presence. In addition to the affect dimensions of empathy, the cognitive dimensions of empathy did not increase in the pattern hypothesized, suggesting the technology modality offered little or no benefit in terms of any increase in cognitive empathy. However, participants in the experimental conditions had significantly higher perspective-taking and fantasy scores compared to participants in the control condition, suggesting that the perspective-taking exercise did increase cognitive empathy. Like affect empathy, the researcher believes this could be a result of cognitive empathy increasing presence rather than presence increasing cognitive empathy. For example, Sas and O'Hare (2003) hypothesized that participants' cognitive empathy traits (i.e., fantasizing and perspective-taking tendency) would correlate with their feelings of presence when participants went through a desktop virtual-reality experience that mimicked different rooms in a building, such as a

conference room, training room, library, and lobby. The researchers found that trait fantasy and presence were moderately correlated ($r = .48, p < .001$). However, trait perspective taking, and presence were not correlated ($r = .12, p > .05$). Sas and O'Hare (2003) investigated further by splitting the data into two groups based on trait fantasy scores (high vs. low trait fantasy) and tested whether those two groups had significantly different presence scores. The results were that participants who scored within in the 70th percentile of trait fantasy (high fantasy) experienced significantly more presence compared to participants who fell below the 70th percentile (low fantasy), $\eta^2p = .23$.

In the current study, to further examine if fantasy could be producing presence (rather than presence producing fantasy), the researcher ran a t-test using the same guidelines as Sas and O'Hare (2003). Like Sas and O'Hare (2003), the researcher created two groups, using Sas and O'Hare's cutoff points: high fantasy (70th percentile) and low fantasy (below the 70th percentile). The control condition was not included in the data because the control condition had lower fantasy than the experimental conditions. There was a significant difference in presence between the high-fantasy group ($M = 3.89, SD = .56$) and the low-fantasy group ($M = 3.44, SD = .54$), $t(151) = 4.87, p < .05$. These results replicate the findings of Sas and O'Hare (2003), strengthening the idea that people who experience high fantasy are more likely to experience more presence compared to people who experience lower fantasy. Taken together, the present study and Sas and O'Hare (2003) provide little evidence to support the idea that presence produces additional fantasy, but they do provide some evidence to suggest that fantasy produces more physical presence. Where Sas and O'Hare (2003) found trait fantasy to be correlated with presence, this research found that state fantasy was correlated with physical presence. This idea should be explored further by systematically altering the degree of fantasy participants

experience during a perspective-taking exercise to see how it affects physical presence, while controlling for trait fantasy.

In terms of perspective taking, some scholars have found a positive relationship between presence and perspective taking (Van Loon et al., 2018). Researchers have used technology to have participants experience what it would be like to have a different skin tone (Groom, Bailenson, & Nass, 2009), to be elderly (Yee & Bailenson, 2006; Oh, Bailenson, Weisz, & Zaki, 2016), and even to see from the perspective of a person who is homeless (Herrera et al., 2018). Some researchers have suggested that it's easier for people to take the perspective of a target when the perspective-taking exercise is in a virtual environment because seeing a virtual environment doesn't require the typical cognitive effort used while engaged in more traditional imagination-based perspective-taking exercise (Oh et al., 2016).

Although studies may have found virtual reality to be a viable option for increasing perspective taking (Herrera et al., 2018; Oh et al., 2016; Van Loon et al., 2018), little evidence exists that certain technology modalities increase perspective taking better than others. To the researcher's knowledge, the only other study to test the advantage of technology modality on perspective-taking was Herrera et al. (2018) who found no significant differences in the amount of self-other overlap (similar to perspective taking) participants experienced between technology modalities. Although Van Loon et al. (2018) didn't test the advantage of technology modality on perspective-taking, they did find perspective-taking to increase in a virtual-reality perspective-taking exercise. Furthermore, presence was required for perspective-taking to increase. The findings by Van Loon et al. (2018) drove the researcher to hypothesize that physical presence could be the key to increasing perspective taking. Therefore, in the current study, the researcher hypothesized that conditions that produce more physical presence would have higher

perspective-taking scores. This hypothesis was not supported by the data, which is more in line with the results obtained by Herrera et al. (2018). Therefore, the research suggests that an increase in physical presence from the technology modality does not increase perspective taking.

In summary, the researcher did not find any evidence to support the idea that the technology modality influences the amount of cognitive or affect empathy experienced during perspective-taking exercises. Although a clear relationship emerged between physical presence and the four dimensions of empathy (i.e., perspective taking, fantasy, empathic concern, and personal distress), the technology modalities that produced the most physical presence did not produce the most perspective taking, fantasy, empathic concern, or personal distress. The researcher believes this pattern could be due to unclear causal timeline between physical presence and each of the dimensions of empathy. Revisiting this relationship would be beneficial as the results of this study appear to suggest that empathy arousal increased physical presence, but presence did not increase empathy arousal. Thus, any increase in physical presence appears to be a factor of the technology. The findings that the technology modality affected physical presence aligns with past research (Herrera et al., 2018; Selzer et al., 2019).

5.2.4 Empathy and public support for supervised injection facilities. Research has demonstrated a positive correlation between empathy and public support (Feldman, Huddy, Wronski, & Lown, 2015; Unnever, Cullen, & Fisher, 2005). This study tested this relationship in a new context and for a highly marginalized group (i.e., injection drug users) to explore whether empathy arousal from mediated perspective-taking exercises carries similar effects across technology modalities. Like past research, this study found a positive correlation between three of the four dimensions of empathy (perspective taking, fantasy, empathic concern) and public support for supervised injection facilities. Empathic concern held the strongest correlation with

public support ($r = .3$), which aligns with prior research suggesting that empathic concern is the emotional state that produces altruism, also known as the empathy-altruism hypothesis (Batson, 1987). The empathy-altruism hypothesis states that the more empathic concern we feel for others, the more motivated we feel to relieve the distress of others (Batson, 1987). In this hypothesis, Batson argues that empathy refers only to “empathic concern” or the emotional state that can be produced from the cognitive state of perspective taking and fantasy (Batson, 2016). There is considerable evidence that demonstrates a link between empathic concern and helping behavior (see Batson, 2011 for review).

Contrary to the positive relationship between empathic concern and helping behavior, research has found the relationship between personal distress and helping behavior is negative under certain circumstances (Batson et al., 1997; Eisenberg et al., 1989; Geangu, 2015). For example, Batson et al. (1997) suggests that the degree to which people can easily escape from the requested helping behavior determines their response to the helping request when personal distress is evoked. According to Batson et al. (1997), personal distress leads to prosocial actions that are motivated to decrease one’s own personal distress. Thus, the decision to engage in helping behavior is dependent on the degree to which people feel they can best alleviate their own distress. If the helping behavior is easily avoidable (e.g., participants are not required to help and the decision to help is confidential and anonymous) the quickest way to alleviate personal distress is to disengage and forget about the situation (e.g., talk across the street and avoid the homeless person in need). However, if participants are given a request that is not easy to escape (e.g., participants think their responses will be tracked), then they tend to alleviate personal distress by obliging with the request (e.g., donating money or volunteering) to lower their own personal distress. Batson’s hypothesized relationship between personal distress and

helping behavior aligns with research findings. For example, Eisenberg et al. (1989) had undergraduates watch a video of a mother and her children in a hospital after a car crash. The mother described a series of unfortunate events leading to concern for the children's and mother's wellbeing. Following, participants read a letter from the mother in which they were asked to volunteer their time to help around the house doing small chores (e.g., raking leaves) to help the family focus their time on healing. The letter emphasized that responses would be confidential, and there would be no penalty if participants chose to not volunteer. Eisenberg et al. (1989) found that participants' intentions to engage in volunteering to help the mother were negatively correlated with personal distress.

One key difference between this study and the study by Eisenberg et al. (1989) is that participants in this study were asked how much they would support a public policy rather than ask them to commit to volunteering their time. The researcher hypothesized that personal distress would be positively correlated with public support for supervised injection facilities because the researcher assumed that the easiest way to reduce personal distress would be to support the public policy for supervised injection facilities. Essentially, the researcher did not think that choosing to not support the public policy would offer an advantage in terms of lowering personal distress. Thus, the researcher thought that most participants would view their support as an easy solution to reduce their personal distress that was primed from the perspective-taking exercise.

The study found that personal distress did not significantly correlate to public support. It could be that the perspective-taking exercise did not produce enough personal distress to see any significant effect, either positive or negative. However, the mean personal distress score across conditions was above the midpoint ($M = 2.94$, $SD = .98$), suggesting that some participants did experience personal distress. Regardless, the strength of the effect was nearly neutral ($r = .06$),

suggesting that personal distress did not have much of an effect on public support. This finding suggests that personal distress does not motivate anonymously supporting public policy. However, the result could be dependent on whether participants perceived the opportunity to publicly support supervised injection facilities as an opportunity to alleviate personal distress. Essentially, if participants perceive the public policy as a helping behavior, then a positive relationship may emerge. Alternatively, if the stakes were higher such that participants' level of public support depended on their behavior rather than attitudes (i.e., volunteering their time to collect signatures versus self-report public policy support), the study may have seen a negative relationship, as suggested by Batson et al. (1997).

Prior literature suggests that the results of this study could have been different if the prosocial ask were private and perceived as costly by participants. For example, research has found that the relationship between empathy arousal and prosocial behavior changes when participant's decision to engage in the prosocial behavior is made private and is perceived as costly such as a large time commitment, high financial commitment, and/or the behavior is perceived as difficult (Carlo & Randall, 2002; Carlo, Hausmann, Christiansen, & Randall, 2003; Eisenberg et al., 1989). Given that this study measured attitudes toward a prosocial policy, rather than prosocial behavior, this study cannot conclude exactly what the relationship would have been between a prosocial behavior and empathy arousal. However, the literature suggests that fewer participants would agree to a costly, private prosocial behavior (e.g., anonymously campaigning for a supervised injection facility) compared to a low-cost, public behavior (e.g., sign this petition) and that participants with more empathy arousal would be more inclined to carry out the costly, private prosocial behavior.

It was hypothesized that conditions with more empathy would see an increase in public support. However, because empathy did not differ across technology modality, the study did not examine how different technology modalities affected public support toward supervised injection facilities. Although perspective taking, fantasy, and empathic concern were all positively correlated with public support, the study failed to find significant differences in empathy between conditions. Thus, it was not possible to examine if conditions with greater empathy also held higher public support for supervised injection facilities. However, the control condition can provide some helpful information regarding the relationship between condition and public support.

If the control condition had significantly lower empathy compared to the experimental conditions (which it did for perspective taking and fantasy), then it could also have significantly lower public support compared to experimental conditions. In testing this hypothesis, results indicate that there was not a statistically significant difference between groups as determined by a one-way ANOVA, $F(3, 196) = .47, p > .05$. The researcher believes these findings speak to a limitation in the study, (i.e., public support was not measured in a way that accurately represents public support toward supervised injection facilities). This issue is addressed in the limitations section (section 5.3).

5.2.4 Head-mount-displays did not reduce stereotypes. Past research found that perspective-taking exercises can inflate stereotypes in situations where the target is engaged in stereotypical behavior (Skorinko & Sinclair, 2013). However, most research suggests that perspective-taking exercises reduce stereotypes (Galinsky & Ku, 2004; Galinsky & Moskowitz, 2000; Johnson, Olivo, Gibson, Reed, & Ashburn-Nardo, 2009). Given that this study did not find a statistically significant difference in the four dimensions of empathy between experimental

conditions, it is not surprising that stereotype-consistent beliefs also did not significantly differ between experimental conditions.

Whether the perspective-taking exercise in the experimental conditions increased or decreased stereotype-consistent beliefs can be examined by comparing the control condition to the experimental conditions. In doing so, the author uncovered an interesting finding. In general, the perspective-taking exercise reduced stereotype-consistent beliefs compared to a control condition, aligning with most of the previous research (Galinsky & Ku, 2004; Galinsky & Moskowitz, 2000; Johnson, Olivo, Gibson, Reed, & Ashburn-Nardo, 2009). However, the head-mount display condition was the only experimental condition that did not have a statistically significant lower stereotype score compared to the control condition, suggesting that the head-mount display condition was less effective at reducing stereotype-consistent beliefs toward people who inject drugs compared to the text narrative condition and the video computer monitor condition.

Past research has found that virtual-reality head-mount displays potentially affect stereotypes towards the marginalized during perspective-taking exercises. Yee and Bailenson (2006) found that participants in a virtual-reality head-mount display simulation who took the perspective of an elderly person held fewer negative word associations with the elderly (e.g., slow) compared to participants who took the perspective of a young person. However, the study did not find stereotype-consistent beliefs to differ between the two groups. Ahn, Minh, and Bailenson (2013) found that participants in an immersive virtual environment who experienced a colorblindness simulation held more favorable attitudes toward those with disabilities compared to participants who imagined being colorblind. However, the study did not specifically test for stereotypes. Similarly, Sri Kalyanaraman et al. (2010) found that a virtual simulation and

perspective-taking written task were effective at increasing positive attitudes towards people with schizophrenia. Again, Sri Kalyanaraman et al. (2010) did not test for stereotypes.

The researcher of this study cannot be certain why the virtual-reality head-mount display condition did not reduce stereotypes as well as the other experimental conditions. However, it is possible that the stereotype-consistent behaviors were more salient in the virtual-reality condition due to the unique ability of virtual reality to simulate physical presence. Ames (2004) found that self-projection (i.e., the ability to shift perspective from the present to alternative perspectives, Buckner & Carroll, 2007) is negatively correlated with stereotypes. However, self-projection is more common in scenarios where the target is like the person going through the perspective-taking exercise (Sun, Zuo, Wu, & Wen, 2016). In instances where the target is not similar, people commonly seek cues to categorical information that match pre-existing stereotypes (Vorauer, Hunter, Main, & Roy, 2000). According to Sun et al. (2016), under certain circumstances people in perspective-taking exercises could rely on one more than the other (i.e., self-projection vs. categorical information).

Given that most participants in this study were unlike the target in the perspective-taking exercise (e.g., no mental health diagnosis), it is possible that they relied on both self-projection (i.e., perspective taking) and cues to categorical information present in the stimuli. However, the increase in physical presence could have made the stereotypical cues more prevalent and prominent in the virtual-reality condition. For example, overdosing in a dirty, graffiti-filled alley could have made certain stereotypes more salient in the virtual-reality head-mount display condition compared to the other experimental conditions due to the increase in physical presence (i.e., perceived spatial, realness, and involvement). Although the results suggest that the virtual-reality condition did not increase stereotypes compared to the control condition, the virtual-

reality condition may have been less effective at reducing them due to the increased salience of certain stereotype-consistent cues afforded by the increase in physical presence.

5.3 Limitations

Although the researcher believes the study to be an important addition to the limited research examining the relationship between technology modality, presence, and empathy, limitations should be addressed in subsequent research.

First, it could be argued that a better scale exists to measure empathy arousal. The researcher measured perspective taking, fantasy, empathic concern, and personal distress by adjusting the interpersonal reactivity index to fit the context of this study. This was done to allow for cross-study comparisons, as most studies that have examined how virtual reality experiences correlate with empathy have based their scales off of the interpersonal reactivity index (Schutte & Stilianovic, 2017; Sri Kalyanaraman et al., 2010; Van Loon et al., 2018). However, the interpersonal reactivity index was initially created to measure trait empathy rather than state empathy. Although scale reliability coefficients for perspective taking, fantasy, empathic concern, and personal distress all exceeded the standard .70 threshold, it is important to recognize that other scales exist that traditionally are used to measure state empathy – especially for empathic concern and personal distress. For example, researchers may use scales developed by Batson, Early, and Salvarani (1997), to measure state empathic concern and personal distress. Batson et al. (1997) asks participants to respond to a scenario by rating how much of a certain adjective they felt. For example, for empathic concern, participants rate the degree to which they felt “compassionate,” “moved,” and “softhearted.” Batson et al. (1997) measures personal distress with adjectives such as “worried,” “disturbed,” and “distressed.” However, these adjectives again mimic or resemble the adjectives used in the interpersonal reactivity index.

Therefore, the researcher felt that staying consistent with prior virtual reality literature was best as it allowed for easier cross-study comparisons.

Second, the author believes the scale to measure public support toward supervised injection facilities should be improved. This study used a modified version of Strike et al.'s (2014) scale, which measured public support for a supervised injection facility in Ontario, Canada. However, upon further examination, the author believes this scale to be flawed. The scale may inflate participants' public support scores because of how some of the scale items are worded. For example, one item on the scale states "supervised injection facilities should be made available in Colorado if it can be shown that they reduce overdose deaths or infectious disease among users" and another states "supervised injection facilities should be made available in Colorado if it can be shown that they reduce neighborhood problems related to injection drug use." These questions are better suited to measure *conditional support* of supervised injection facilities rather than participants' current support toward supervised injection facilities.

The scale is worded such that participants may assume that supervised injection facilities have already proven themselves to be effective at reducing overdose death, infectious disease, neighborhood crime, and at increasing contact with social workers, etc. However, the research to date suggests that supervised injection facilities have only been successful at reducing overdoses and infectious disease spread. Research has not concluded that these facilities reduce neighborhood crime or increase contact with social works. This operationalization shortcoming could explain why the author did not find a difference in public support between the experimental conditions and the control condition even though empathy was correlated with public support and each experimental condition held higher cognitive empathy scores compared to the control condition.

Third, the researcher decided to have the control condition briefly imagine what a supervised injection facility looked like, the types of people who would go there, and what it would look like to see someone overdose on illegal injection drugs. The researcher did this to examine the degree to which simply thinking about people who inject drugs would foster cognitive and affect empathy toward those people and check to ensure that the experimental conditions were effectively primed to engage in perspective taking. The imagination task was like the perspective-taking exercise in terms of content themes, but participants were not primed to take the perspective of anyone. Thus, by comparing the experimental conditions that did receive a prime to the control condition that did not receive a prime, the researcher was able to ensure that the experimental conditions received content that actually primed them to take the perspective of an injection drug user better than a condition that had participants think about injection drug users. In this sense, it allowed the researcher to ensure that the experimental conditions received an effective perspective-taking prime. The trade off to this decision was that the control condition still received some stimuli, which could have interfered with baseline empathy toward injection drug users and baseline support toward supervised injection facilities.

Fourth, this study uses a post-test only design. The researcher made this decision for numerous reasons. As identified in section 3.1, the researcher was unable to measure presence until the participants used the technology. That is, there is no baseline presence score for pre-test and post-test comparisons. Second, empathy toward an individual or group is context specific and cannot have a baseline value. Although the tendency to empathize can have a baseline value (Davis, 1983), the act of empathizing with an individual or group is specific to the context that primes the individual to engage in the empathy process. The limitation to this approach is that the researcher was unable to control for baseline tendency to empathize. Although participants

were randomly assigned to conditions, the post-test only design does not allow the researcher to know for certain if baseline tendency to empathize was higher for certain conditions. If baseline tendency to empathize was higher for certain conditions, then those conditions could have inflated empathy scores because the participants in the condition were more likely to empathize to begin with. A pretest/posttest design could have helped address this concern. For example, the researcher could have used the interpersonal reactivity index as a pre-test measure of tendency to empathize along with the Batson et al. (1997) measure for state empathic concern and personal distress. This would have allowed researchers to examine if state empathic concern and personal distress increased from the perspective-taking exercise even after controlling for participant's tendency to empathize.

Fifth, it could be that the virtual-reality technology did not afford the user to empathize because certain technological and narrative features were missing. As prior research has found, it is easier to empathize with people who you see as similar (McKeever, 2012; Rüsç et al., 2009). Although the stimuli used in this study contained multiple primes throughout the experience from the narrator, the virtual-reality technology did not afford the user an opportunity to experience additional primes, such as seeing their clothing or injection marks on their arm. As Peck et al. (2013) found, virtual-reality perspective-taking exercises that allowed the user to see the skin of their avatar reduced implicit racial bias towards minority groups in which the avatar shared the same skin color. However, these effects disappeared when the avatar did not share the same skin color as the minority group. The ability for virtual reality to engage individuals in perspective-taking is unique because of these additional semi-autonomous priming opportunities (e.g., lifting your arm and seeing a needle mark). However, this study did not fully leverage the functionality of virtual reality, thus priming opportunities were limited.

Last, this study was limited in that it only examines one topic, and one treatment of that topic. Although the findings in this study are generally in line with prior research, there is still an overall lack of studies examining the relationship between technology modality, physical presence, empathy, and empathy-driven outcomes. For example, it is possible that the relationships found in this study could differ across topics (e.g., empathy toward people who have cancer). It's also possible that participants who receive a different treatment of the same topic (e.g., someone overdoses in a middle-class family with their children in the next room versus in a dark, graffiti-filled street) could experience a different outcome from the perspective-taking exercise.

CHAPTER SIX: CONCLUSION

6.1 Conclusion

Virtual-reality head-mount displays are an effective means to increase physical presence during perspective-taking exercises. This research found physical presence to be positively correlated with three empathy dimensions: perspective-taking, fantasy, and personal distress. The relationship between physical presence and empathic concern, the fourth empathy dimension was moderated by participants' mental health status.

Although dimensions of empathy did not differ between experimental conditions, the researcher believes this study may have inadvertently found support for a causal relationship between empathy arousal and physical presence. This study found that virtual reality does not appear to be superior at evoking empathy towards the marginalized compared to more traditional and affordable technology experiences such as simply reading a text narrative and viewing photographs. Additional studies should leverage the full potential of virtual reality (e.g., free-range motion, haptics, etc.) to examine how these relationships may change with larger differences in physical presence between conditions, as the effect sizes in this study were small.

One limitation to using virtual reality head-mount displays for perspective-taking may be their inability to reduce stereotypes, at least compared to other forms of technology modalities such as desktop virtual reality and text narratives with photographs. Considering this research, content creators should carefully consider the relative advantage of virtual-reality perspective-taking exercises compared to more traditional approaches because virtual reality may not currently offer users an experience that meets the assumed benefits.

6.2 Future Research

Subsequent research should examine how new technologies can continue to increase physical presence. The researcher of this study suggests examining the incremental benefits of improved haptics such as realistic hand movement, walking, and engaging in other senses such as smell during virtual-reality experiences. It is possible that virtual-reality head-mount displays have only begun to demonstrate their ability at replicating real-world experiences. Thus, researchers can expect virtual-reality perspective-taking exercises to become more realistic, having implications for physical presence. Although the results of this study do not suggest that physical presence increases empathy, Van Loon et al. (2018) found some evidence to suggest that empathic concern will only increase from virtual-reality perspective-taking exercises if participants feel a high level of physical presence. Thus, it is possible that virtual reality can be an effective tool for increasing certain emotions, but viewing 360-degree videos through low-cost, head-mount displays are unlikely to produce these effects. Future research should consider testing the full capabilities of virtual reality at inducing physical presence. As such, rather than comparing different technology modalities, future research should examine whether state-of-the-art virtual reality is better able to influence high levels of physical presence compared to more rudimentary VR technology. Studies should assess the effect of additional technological capabilities such as room-scale mobility, hand tracking, and immersive audio on physical presence as well as how high levels of perceived physical presence influence outcome variables such as emotion arousal. Similarly, it is worthwhile to consider if emerging virtual-reality systems are meeting user expectations and gratifications.

Although studying small nuanced changes between older and newer forms of technology can help identify the relative advantage of emerging technology, focusing on uses and

gratifications can help identify how user experiences are shaped by their expectations as well as the technology modality's ability to gratify the needs of the user. Broadly speaking, uses and gratifications theorizes that technology users have specific needs which factor into their media and technology selection process (Rubin, 2009). For example, prior research has identified perceived Twitter gratifications as information sharing, social interaction, entertainment, self-documentation, self-expression, convenience, connection, and time passing (Liu, Cheung, & Lee, 2010). On the other hand, perceived video game gratifications include competition, social interaction, diversion, escape, challenge, arousal, fantasy, and entertainment (Lucas & Sherry, 2004). Although social and psychological gratifications tend to overlap between new and old media technologies, Sundar and Limperos (2013) suggest that uses and gratifications research focus on an affordance-based framework for identifying gratifications from new technologies such as virtual reality. That is, rather than focusing exclusively on social and psychological needs (e.g., the need to feel connected to others), uses and gratifications research should triangulate the social and psychological needs with technology-driven needs such as a desire to experience a novel technology and feel physically present. In this study, participants in the virtual-reality conditions may not have had their gratifications met. Going into the study, participants may have held expectations related to newer and more sophisticated forms of virtual reality such as the ability to walk around and interact with the virtual people in the perspective-taking exercise. Future research should continue to explore how expectations of virtual-reality experiences impact user experience and help facilitate perceptual outcomes such as physical presence. However, perhaps even more important, future research should identify the gratifications users seek from virtual-reality technology.

Since uses for virtual reality vary heavily from industry training to gaming, it is possible that immersive content developers are unclear as to what the user is expecting and seeking from these experiences. For example, a person seeking virtual-reality video games are likely driven by different motivations and expecting different technological features and affordances compared to a human resources professional looking to create virtual-reality educational training videos. For the craft of virtual-reality content to advance, content creators need to know what the audience is seeking and how virtual-reality content can help deliver the expected gratification across these various uses.

Research should continue to explore the causal relationship between physical presence and cognitive and affect empathy. Evidence clearly supports a positive correlation. However, studies have either neglected to explore the causal effect, have done so with limited measurements, or have found mixed results. There is evidence that both cognitive and affect empathy may be increasing presence. However, Van Loon et al. (2018) found presence to be a requirement for a relationship to emerge between perspective taking and empathic concern in virtual-reality perspective taking, which seems to suggest that high levels of presence can help produce empathic concern during perspective-taking exercises. Further research should explore how incremental increases to affect (personal distress and/or empathic concern) empathy influence physical presence as well as how incremental increases to cognitive (perspective-taking and fantasy) influence physical presence.

Third, research should examine how individual differences influence empathy arousal, especially in scenarios where the empathy target is highly stigmatized such as the case with injection drug users. There are numerous individual differences to consider. First, as already reported in the limitations, future research should consider controlling for tendency to empathize.

This could be accomplished by using a pretest/posttest design and measuring tendency to empathize at pretest and state affect empathy at posttest. This allows the researcher to control for participants' tendency to engage in perspective taking and fantasizing as well as the degree to which they typically feel personal distress and empathic concern across various contexts. Second, it would be worthwhile to see how perceptions of choice influence the ability to empathize with highly stigmatized groups such as people with mental illness. Prior research has found that when the concept of "choice" is activated, people have less support for public policies impacting intergroup equality and societal benefits and increased support for policies promoting individual rights (Savani, Stephens, & Markus, 2011). Furthermore, activating "choice" has been shown to increase victim blaming and decrease empathy toward the marginalized (Savani et al., 2011). Future research that examines empathy toward injection drug users should consider controlling for the degree to which participants feel that injection drug users are to blame for their own choices (i.e., internal locus of control). It is possible that the more participants feel that addiction is a choice, the less likely they are to empathize with injection drug users. Third, literature suggests that familiarity moderates both cognitive and affective empathy (Yu & Chou, 2018). Studies have shown that the regions of the brain responsible for cognitive and affective empathy are more active when people see familiar friends in pain versus strangers in pain (Meyer et al., 2012). This study tried to control for this by having participants' self-report whether they had close friends or family members with injection drug use history. However, future research should consider controlling for this by asking participants if they have friends or family members with addiction history as this may be a more accurate way to measure whether or not participants are familiar with the behaviors associated with addiction. Furthermore, studies should consider controlling for generally familiarity with drug/alcohol addiction as past research

suggests that those with a prior impression about a subject are more likely to engage in cognitive empathy (Mitchell et al., 2004; Yu et al., 2016). Last, future studies should consider how implicit bias mediates and/or moderates empathy toward injection drug users. Although studies have found that empathy arousal reduces implicit bias against marginalized groups (Shih, Stotzer, & Gutiérrez, 2013; Sternadori, 2017; Teachman, Gapinski, Brownell, Rawlins, & Jeyaram, 2003), fewer studies have examined how empathy arousal may be hindered by strong implicit bias towards the empathy target.

Fourth, research should continue to explore whether virtual-reality head-mount displays are unable to reduce stereotypes as effectively as are other technology modalities. This study only looked at one marginalized group (i.e., people who inject drugs). It would be worthwhile to see if virtual-reality perspective-taking exercises are unable to reduce stereotypes regardless of the target group, and if so, why this is the case. Of interest would be the perceived salience of stereotype-consistent cues in virtual-reality head-mount display experiences compared to other technology modalities such as text narratives and videos.

REFERENCES

- Ahern, J., Stuber, J., & Galea, S. (2007). Stigma, discrimination and the health of illicit drug users. *Drug and alcohol dependence*, 88(2-3), 188-196.
- Ahn, S. J., Le, A. M. T., & Bailenson, J. (2013). The effect of embodied experiences on self-other merging, attitude, and helping behavior. *Media Psychology*, 16(1), 7-38.
- Alaraj, A., Lemole, M. G., Finkle, J. H., Yudkowsky, R., Wallace, A., Luciano, C., ... & Charbel, F. T. (2011). Virtual reality training in neurosurgery: review of current status and future applications. *Surgical neurology international*, 2.
- Alsina-Jurnet, I., Gutiérrez-Maldonado, J., & Rangel-Gómez, M.-V. (2011). The role of presence in the level of anxiety experienced in clinical virtual environments. *Computers in Human Behavior*, 27(1), 504-512.
- Ames, D. R. (2004). Inside the mind reader's tool kit: projection and stereotyping in mental state inference. *Journal of personality and social psychology*, 87(3), 340.
- Anderson-Hanley, C., Snyder, A. L., Nimon, J. P., & Arciero, P. J. (2011). Social facilitation in virtual reality-enhanced exercise: competitiveness moderates exercise effort of older adults. *Clinical interventions in aging*, 6, 275.
- Bagozzi, R. P., & Moore, D. J. (1994). Public service advertisements: Emotions and empathy guide prosocial behavior. *Journal of Marketing*, 58(1), 56-70.
- Banakou, D., Hanumanthu, P. D., & Slater, M. (2016). Virtual embodiment of white people in a black virtual body leads to a sustained reduction in their implicit racial bias. *Frontiers in human neuroscience*, 10, 601.
- Baños, R. M., Botella, C., Alcañiz, M., Liaño, V., Guerrero, B., & Rey, B. (2004). Immersion and emotion: their impact on the sense of presence. *Cyberpsychology & behavior*, 7(6), 734-741.
- Baños, R. M., Botella, C., Rubió, I., Quero, S., García-Palacios, A., & Alcañiz, M. (2008). Presence and emotions in virtual environments: The influence of stereoscopy. *CyberPsychology & Behavior*, 11(1), 1-8.
- Baños, R. M., Etchemendy, E., Castilla, D., García-Palacios, A., Quero, S., & Botella, C. (2012). Positive mood induction procedures for virtual environments designed for elderly people. *Interacting with Computers*, 24(3), 131-138.
- Bardwell, G., Scheim, A., Mitra, S., & Kerr, T. (2017). Assessing support for supervised injection services among community stakeholders in London, Canada. *International Journal of Drug Policy*, 48, 27-33.

- Barry, C. L., McGinty, E. E., Pescosolido, B. A., & Goldman, H. H. (2014). Stigma, discrimination, treatment effectiveness, and policy: public views about drug addiction and mental illness. *Psychiatric Services*, 65(10), 1269-1272.
- Barry, C. L., Sherman, S. G., Stone, E., Kennedy-Hendricks, A., Niederdeppe, J., Linden, S., & McGinty, E. E. (2019). Arguments supporting and opposing legalization of safe consumption sites in the US. *International Journal of Drug Policy*, 63, 18-22.
- Batson, C. D., & Shaw, L. L. (1991). Evidence for altruism: Toward a pluralism of prosocial motives. *Psychological inquiry*, 2(2), 107-122.
- Batson, C. D., Early, S., & Salvarani, G. (1997). Perspective taking: Imagining how another feels versus imagining how you would feel. *Personality and social psychology bulletin*, 23(7), 751-758.
- Batson, C. D., Sympson, S. C., Hindman, J. L., Decruz, P., Todd, R. M., Weeks, J. L., ... & Burns, C. T. (1996). "I've been there, too": Effect on empathy of prior experience with a need. *Personality and social psychology bulletin*, 22(5), 474-482.
- Batson, C. D., & Ahmad, N. Y. (2009). Empathy-induced altruism: A threat to the collective good. In *Altruism and Prosocial Behavior in Groups* (pp. 1-23). Emerald Group Publishing Limited.
- Batson, C. D., Chang, J., Orr, R., & Rowland, J. (2002). Empathy, attitudes, and action: Can feeling for a member of a stigmatized group motivate one to help the group?. *Personality and Social Psychology Bulletin*, 28(12), 1656-1666.
- Batson, C. D., Polycarpou, M. P., Harmon-Jones, E., Imhoff, H. J., Mitchener, E. C., Bednar, L. L., ... & Highberger, L. (1997). Empathy and attitudes: Can feeling for a member of a stigmatized group improve feelings toward the group?. *Journal of personality and social psychology*, 72(1), 105.
- Batson, C. D., & Powell, A. A. (2003). Altruism and prosocial behavior. *Handbook of psychology*, 463-484.
- Behm-Morawitz, E., Pennell, H., & Speno, A. G. (2016). The effects of virtual racial embodiment in a gaming app on reducing prejudice. *Communication Monographs*, 83(3), 396-418.
- Benhamou, Y., Bochet, M., Di Martino, V., Charlotte, F., Azria, F., Coutellier, A., ... & Poynard, T. (1999). Liver fibrosis progression in human immunodeficiency virus and hepatitis C virus coinfecting patients. *Hepatology*, 30(4), 1054-1058.
- Beyrer, C., Malinowska-Sempruch, K., Kamarulzaman, A., & Strathdee, S. A. (2010). 12 myths about HIV/AIDS and people who use drugs. *The Lancet*, 376(9737), 208-211.

- Binswanger, I. A., Kral, A. H., Bluthenthal, R. N., Rybold, D. J., & Edlin, B. R. (2000). High prevalence of abscesses and cellulitis among community-recruited injection drug users in San Francisco. *Clinical Infectious Diseases*, 30(3), 579-581.
- Binswanger, I. A., Takahashi, T. A., Bradley, K., Dellit, T. H., Benton, K. L., & Merrill, J. O. (2008). Drug users seeking emergency care for soft tissue infection at high risk for subsequent hospitalization and death. *Journal of studies on alcohol and drugs*, 69(6), 924-932.
- Biocca, F., & Levy, M. R. (Eds.). (2013). *Communication in the age of virtual reality*. Routledge.
- Biocca, F., & Delaney, B. (1995). Immersive virtual reality technology. *Communication in the age of virtual reality*, 15, 32.
- Blair, R. J. R. (2005). Responding to the emotions of others: Dissociating forms of empathy through the study of typical and psychiatric populations. *Consciousness and cognition*, 14(4), 698-718.
- Bouchard, S., St-Jacques, J., Robillard, G., & Renaud, P. (2008). Anxiety increases the feeling of presence in virtual reality. *Presence: Teleoperators and Virtual Environments*, 17(4), 376-391.
- Bracken, C. C. (2005). Presence and image quality: The case of high-definition television. *Media psychology*, 7(2), 191-205.
- Buckner, R. L., & Carroll, D. C. (2007). Self-projection and the brain. *Trends in cognitive sciences*, 11(2), 49-57.
- Cao, X. (2013). The effects of facial close-ups and viewers' sex on empathy and intentions to help people in need. *Mass Communication and Society*, 16(2), 161-178.
- Carlo, G., & Randall, B. A. (2002). The development of a measure of prosocial behaviors for late adolescents. *Journal of youth and adolescence*, 31(1), 31-44.
- Carlo, G., Hausmann, A., Christiansen, S., & Randall, B. A. (2003). Sociocognitive and behavioral correlates of a measure of prosocial tendencies for adolescents. *The journal of early adolescence*, 23(1), 107-134.
- Carù, A., & Cova, B. (2007). Consumer immersion in an experiential context. *Consuming experience*, 34-47.
- Cardwell, M. (1999). *Dictionary of psychology*. Chicago, IL: Fitzroy Dearborn.
- Carrera, P., Ocejja, L., Caballero, A., Muñoz, D., López-Pérez, B., & Ambrona, T. (2013). I feel so sorry! Tapping the joint influence of empathy and personal distress on helping behavior. *Motivation and Emotion*, 37(2), 335-345.

- Centers for Disease Control and Prevention (CDC). (2001). Soft tissue infections among injection drug users--San Francisco, California, 1996-2000. *MMWR. Morbidity and mortality weekly report*, 50(19), 381.
- CDC. (2016, November). *HIV and Injection Drug Use*. Retrieved from <https://www.cdc.gov/hiv/pdf/risk/cdc-hiv-idu-fact-sheet.pdf>
- CDC. (2018, November). *Injection Drug Use and HIV Risk*. Retrieved from <https://www.cdc.gov/hiv/risk/idu.html>
- CDC. (2019, January). *Epidemiology and Prevention of HIV and Viral Hepatitis Co-infections*. Retrieved from <https://www.cdc.gov/hepatitis/populations/hiv.htm>
- Cialdini, R. B. (1991). Altruism or egoism? That is (still) the question. *Psychological Inquiry*, 2(2), 124-126.
- Cheetham, M., Hänggi, J., & Jancke, L. (2014). Identifying with fictive characters: structural brain correlates of the personality trait 'fantasy'. *Social cognitive and affective neuroscience*, 9(11), 1836-1844.
- Clore, G. L., & Jeffery, K. M. (1972). Emotional role playing, attitude change, and attraction toward a disabled person. *Journal of personality and social psychology*, 23(1), 105.
- Davis, M. H. (1983a). Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of personality and social psychology*, 44(1), 113.
- Davis, M. H. (1983b). The effects of dispositional empathy on emotional reactions and helping: A multidimensional approach. *Journal of personality*, 51(2), 167-184.
- Davis, M. H., Conklin, L., Smith, A., & Luce, C. (1996). Effect of perspective taking on the cognitive representation of persons: a merging of self and other. *Journal of personality and social psychology*, 70(4), 713.
- Davis, M. H. (2006). Empathy. In *Handbook of the sociology of emotions* (pp. 443-466). Springer, Boston, MA.
- DeBeck, K., Kerr, T., Bird, L., Zhang, R., Marsh, D., Tyndall, M., ... & Wood, E. (2011). Injection drug use cessation and use of North America's first medically supervised safer injecting facility. *Drug and alcohol dependence*, 113(2-3), 172-176.
- Decety, J. E., & Ickes, W. E. (2009). *The social neuroscience of empathy*. MIT Press.
- Decety, J., & Meyer, M. (2008). From emotion resonance to empathic understanding: A social developmental neuroscience account. *Development and psychopathology*, 20(4), 1053-1080.
- Decety, J., & Lamm, C. (2011). Empathy versus Personal Distress: Recent Evidence from Social Neuroscience. In J. E. Decety, & W. E. Ickes (Eds.), *The social neuroscience of empathy*, (pp. 199 – 212). MIT Press.

- Devlin, H. C., Zaki, J., Ong, D. C., & Gruber, J. (2016). Tracking the emotional highs but missing the lows: Hypomania risk is associated with positively biased empathic inference. *Cognitive Therapy and Research*, 40(1), 72-79.
- Dooley, K. (2017). Storytelling with virtual reality in 360-degrees: a new screen grammar. *Studies in Australasian Cinema*, 11(3), 161-171.
- Dyer, E., Swartzlander, B. J., & Gugliucci, M. R. (2018). Using virtual reality in medical education to teach empathy. *Journal of the Medical Library Association: JMLA*, 106(4), 498.
- Ebright, J. R., & Pieper, B. (2002). Skin and soft tissue infections in injection drug users. *Infectious Disease Clinics*, 16(3), 697-712.
- Elmezeny, A., Edenhofer, N., & Wimmer, J. (2018). Immersive storytelling in 360-degree videos: An analysis of interplay between narrative and technical immersion. *Journal of Virtual Worlds Research*, 11(1), 1-13.
- Fabi, S., Weber, L. A., & Leuthold, H. (2019). Empathic concern and personal distress depend on situational but not dispositional factors. *PloS one*, 14(11).
- Fang, X., & Zhao, F. (2010). Personality and enjoyment of computer game play. *Computers in Industry*, 61(4), 342-349.
- Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior research methods*, 39(2), 175-191.
- Feldman, S., Huddy, L., Wronski, J., & Lown, P. (2015). When empathy succeeds and fails: Public support for social welfare policies. In *New York area political psychology workshop*.
- Felnhöfer, A., Kothgassner, O. D., Hauk, N., Beutl, L., Hlavacs, H., & Kryspin-Exner, I. (2014). Physical and social presence in collaborative virtual environments: Exploring age and gender differences with respect to empathy. *Computers in Human Behavior*, 31, 272-279.
- Field, T. M., Woodson, R., Greenberg, R., & Cohen, D. (1982). Discrimination and imitation of facial expression by neonates. *Science*, 218(4568), 179-181.
- Fischer, B., Rehm, J., Kim, G., & Robins, A. (2002). Safer injection facilities (Supervised injection facilities) for injection drug users (IDUs) in Canada: A review and call for an evidence-focused pilot trial. *Canadian Journal of Public Health/Revue Canadienne de Sante'e Publique*, 93(5), 336-338.
- Fromberger, P., Meyer, S., Kempf, C., Jordan, K., & Müller, J. L. (2015). Virtual viewing time: the relationship between presence and sexual interest in androphilic and gynephilic men. *PloS one*, 10(5), e0127156.

- Fultz, J., Batson, C. D., Fortenbach, V. A., McCarthy, P. M., & Varney, L. L. (1986). Social evaluation and the empathy–altruism hypothesis. *Journal of personality and social psychology*, 50(4), 761.
- Galinsky, A. D., Ku, G., & Wang, C. S. (2005). Perspective-taking and self-other overlap: Fostering social bonds and facilitating social coordination. *Group Processes & Intergroup Relations*, 8(2), 109-124.
- Galinsky, A. D., Wang, C. S., & Ku, G. (2008). Perspective-takers behave more stereotypically. *Journal of personality and social psychology*, 95(2), 404.
- Galinsky, A. D., & Moskowitz, G. B. (2000). Perspective-taking: decreasing stereotype expression, stereotype accessibility, and in-group favoritism. *Journal of personality and social psychology*, 78(4), 708.
- Galinsky, A. D., & Ku, G. (2004). The effects of perspective-taking on prejudice: The moderating role of self-evaluation. *Personality and Social Psychology Bulletin*, 30(5), 594-604.
- Gallagher, A. G., & Cates, C. U. (2004). Approval of virtual reality training for carotid stenting: what this means for procedural-based medicine. *Jama*, 292(24), 3024-3026.
- Garza, F. (2015, December). *With Google's New Immersive Videos, You can Feel What it's Like to be a Ballet Dancer*. Retrieved from <https://qz.com/562697/with-googles-new-immersive-videos-you-can-feel-what-its-like-to-be-a-ballet-dancer/>
- Garton, A. F., & Gringart, E. (2005). The Development of a Scale to Measure Empathy in 8-and 9-Year Old Children. *Australian Journal of Educational & Developmental Psychology*, 5, 17-25.
- Gopnik, A., & Wellman, H. M. (1992). Why the child's theory of mind really is a theory. *Mind & Language*, 7(1-2), 145-171.
- Graham, C. S., Baden, L. R., Yu, E., Mrus, J. M., Carnie, J., Heeren, T., & Koziel, M. J. (2001). Influence of human immunodeficiency virus infection on the course of hepatitis C virus infection: a meta-analysis. *Clinical infectious diseases*, 33(4), 562-569.
- Greengard, S. (2019). *Virtual Reality*. Mit Press.
- Groom, V., Bailenson, J. N., & Nass, C. (2009). The influence of racial embodiment on racial bias in immersive virtual environments. *Social Influence*, 4(3), 231-248.
- Gruen, R. J., & Mendelsohn, G. (1986). Emotional responses to affective displays in others: The distinction between empathy and sympathy. *Journal of Personality and Social Psychology*, 51(3), 609.
- Harris, R. E., Richardson, J., Frasso, R., & Anderson, E. D. (2018). Perceptions about supervised injection facilities among people who inject drugs in Philadelphia. *International Journal of Drug Policy*, 52, 56-61.

- Haviland, J. M., & Lelwica, M. (1987). The induced affect response: 10-week-old infants' responses to three emotion expressions. *Developmental psychology*, 23(1), 97.
- Hedrich, D. (2004). *European report on drug consumption rooms* (p. 8). Luxembourg: Office for Official Publications of the European Communities.
- Hendrix, C., & Barfield, W. (1996). Presence within virtual environments as a function of visual display parameters. *Presence: Teleoperators & Virtual Environments*, 5(3), 274-289.
- Herrera, F., Bailenson, J., Weisz, E., Ogle, E., & Zaki, J. (2018). Building long-term empathy: A large-scale comparison of traditional and virtual reality perspective-taking. *PloS one*, 13(10), e0204494.
- Heeter, C. (1992). Being there: The subjective experience of presence. *Presence: Teleoperators & Virtual Environments*, 1(2), 262-271.
- Hodges, S. D., Kiel, K. J., Kramer, A. D., Veach, D., & Villanueva, B. R. (2010). Giving birth to empathy: The effects of similar experience on empathic accuracy, empathic concern, and perceived empathy. *Personality and Social Psychology Bulletin*, 36(3), 398-409.
- IJsselsteijn, W., de Ridder, H., Hamberg, R., Bouwhuis, D., & Freeman, J. (1998). Perceived depth and the feeling of presence in 3DTV. *Displays*, 18(4), 207-214.
- IJsselsteijn, W. A. (2003). Presence in the past: what can we learn from media history? In *Being there: concepts, effects and measurements of user presence in synthetic environments* (pp. 17-40). Ios Press.
- Jackson, P. L., Rainville, P., & Decety, J. (2006). To what extent do we share the pain of others? Insight from the neural bases of pain empathy. *Pain*, 125(1), 5-9.
- Kerr, T., Kimber, J., & Rhodes, T. (2007). Drug use settings: an emerging focus for research and intervention. *International Journal of Drug Policy*, 18(1), 1-4.
- Kolasinski, E. M. (1995). *Simulator Sickness in Virtual Environments* (No. ARI-TR-1027). Army research Inst for the behavioral and social sciences Alexandria VA.
- Kolla, G., Strike, C., Watson, T. M., Jairam, J., Fischer, B., & Bayoumi, A. M. (2017). Risk creating and risk reducing: Community perceptions of supervised consumption facilities for illicit drug use. *Health, Risk & Society*, 19(1-2), 91-111.
- Kongsilp, S., & Dailey, M. N. (2017). Motion parallax from head movement enhances stereoscopic displays by improving presence and decreasing visual fatigue. *Displays*, 49, 72-79.
- Kral, A. H., Wenger, L., Carpenter, L., Wood, E., Kerr, T., & Bourgois, P. (2010). Acceptability of a safer injection facility among injection drug users in San Francisco. *Drug and alcohol dependence*, 110(1-2), 160-163.
- Kral, A. H., & Davidson, P. J. (2017). Addressing the Nation's opioid epidemic: lessons from an unsanctioned supervised injection site in the US. *American journal of preventive medicine*, 53(6), 919-922.

- Krales, A. (Photographer). (2020, January 21). *Untitled* [digital image]. Retrieved from <https://www.theverge.com/2020/1/21/21075920/facebook-oculus-business-go-dropped-virtual-reality-headset-support-quest>
- Krauss, R. M., & Fussell, S. R. (1991). Perspective-taking in communication: Representations of others' knowledge in reference. *Social cognition*, 9(1), 2-24.
- Krijn, M., Emmelkamp, P. M., Olafsson, R. P., & Biemond, R. (2004). Virtual reality exposure therapy of anxiety disorders: A review. *Clinical psychology review*, 24(3), 259-281.
- Kuze, J., & Ukai, K. (2008). Subjective evaluation of visual fatigue caused by motion images. *Displays*, 29(2), 159-166.
- Loomis, J. M., Blascovich, J. J., & Beall, A. C. (1999). Immersive virtual environment technology as a basic research tool in psychology. *Behavior research methods, instruments, & computers*, 31(4), 557-564.
- Liu, I. L., Cheung, C. M., & Lee, M. K. (2010). Understanding Twitter Usage: What Drive People Continue to Tweet. *Pacis*, 92, 928-939.
- Lu, D. (2016). Virtual Reality sickness during immersion: An investigation of potential obstacles towards general accessibility of VIRTUAL-REALITY technology.
- Lucas, K., & Sherry, J. L. (2004). Sex differences in video game play: A communication-based explanation. *Communication research*, 31(5), 499-523.
- Maister, L., Sebanz, N., Knoblich, G., & Tsakiris, M. (2013). Experiencing ownership over a dark-skinned body reduces implicit racial bias. *Cognition*, 128(2), 170-178.
- Malkin, I. (2001). Establishing supervised injecting facilities: A responsible way to help minimise harm. *Melb. UL Rev.*, 25, 680.
- Matney, L. (2019, June 10). *Oculus Sold \$5 Million Worth of Quest Content in First 2 Weeks on Sale. Tech Crunch.* <https://techcrunch.com/2019/06/10/oculus-sold-5-million-worth-of-quest-content-in-first-2-weeks-on-sale/>
- McComas, J., MacKay, M., & Pivik, J. (2002). Effectiveness of virtual reality for teaching pedestrian safety. *CyberPsychology & Behavior*, 5(3), 185-190.
- McGinty, E. E., Barry, C. L., Stone, E. M., Niederdeppe, J., Kennedy-Hendricks, A., Linden, S., & Sherman, S. G. (2018). Public support for safe consumption sites and syringe services programs to combat the opioid epidemic. *Preventive medicine*, 111, 73-77.
- Mehrabian, A., Young, A. L., & Sato, S. (1988). Emotional empathy and associated individual differences. *Current Psychology*, 7(3), 221-240.
- Mestre, D., Fuchs, P., Berthoz, A., & Vercher, J. L. (2006). Immersion et présence. *Le traité de la réalité virtuelle. Paris: Ecole des Mines de Paris*, 309-38.

- Mestre, D. R., Maïano, C., Dagonneau, V., & Mercier, C. S. (2011). Does virtual reality enhance exercise performance, enjoyment, and dissociation? an exploratory study on a stationary bike apparatus. *Presence: Teleoperators and Virtual Environments*, 20(1), 1-14.
- Metz, R. (2017, January 31). *Here's What Happens When You Add Scent to Virtual Reality*. MIT Technology Review. <https://www.technologyreview.com/2017/01/31/5722/heres-what-happens-when-you-add-scent-to-virtual-reality/>
- Meyer, M. L., Masten, C. L., Ma, Y., Wang, C., Shi, Z., Eisenberger, N. I., & Han, S. (2013). Empathy for the social suffering of friends and strangers recruits distinct patterns of brain activation. *Social cognitive and affective neuroscience*, 8(4), 446-454.
- Milloy, M. S., Kerr, T., Tyndall, M., Montaner, J., & Wood, E. (2008). Estimated drug overdose deaths averted by North America's first medically-supervised safer injection facility. *PLoS One*, 3(10), e3351.
- Minsky, M. (1980). Telepresence.
- Mitchell, J. P., Macrae, C. N., & Banaji, M. R. (2004). Encoding-specific effects of social cognition on the neural correlates of subsequent memory. *Journal of Neuroscience*, 24(21), 4912-4917.
- Morina, N., Ijntema, H., Meyerbröcker, K., & Emmelkamp, P. M. (2015). Can virtual reality exposure therapy gains be generalized to real-life? A meta-analysis of studies applying behavioral assessments. *Behaviour research and therapy*, 74, 18-24.
- Muhlbach, L., Bocker, M., & Prussog, A. (1995). Telepresence in videocommunications: A study on stereoscopy and individual eye contact. *Human Factors*, 37(2), 290-305.
- Munyan III, B. G., Neer, S. M., Beidel, D. C., & Jentsch, F. (2016). Olfactory stimuli increase presence in virtual environments. *PloS one*, 11(6).
- Natan, M. B., Beyil, V., & Neta, O. (2009). Nurses' perception of the quality of care they provide to hospitalized drug addicts: Testing the theory of reasoned action. *International Journal of Nursing Practice*, 15(6), 566-573.
- National Institute on Drug Abuse. (2019, January). *Opioid Overdose Crisis*. Retrieved from <https://www.drugabuse.gov/drugs-abuse/opioids/opioid-overdose-crisis>
- National Institute on Drug Abuse. (2018, May). *Fentanyl and Other Synthetic Opioids Drug Overdose Deaths*. Retrieved from <https://www.drugabuse.gov/related-topics/trends-statistics/infographics/fentanyl-other-synthetic-opioids-drug-overdose-deaths>
- National Institute on Drug Abuse. (2020, March 10). *Overdose death rates*. <https://www.drugabuse.gov/drug-topics/trends-statistics/overdose-death-rates>
- Navarrete, C. D., McDonald, M. M., Mott, M. L., & Asher, B. (2012). Virtual morality: Emotion and action in a simulated three-dimensional “trolley problem”. *Emotion*, 12(2), 364.

- Neumann, D. L., Chan, R. C., Boyle, G. J., Wang, Y., & Westbury, H. R. (2015). Measures of empathy: Self-report, behavioral, and neuroscientific approaches. In *Measures of personality and social psychological constructs* (pp. 257-289). Academic Press.
- Nummenmaa, L., Hirvonen, J., Parkkola, R., & Hietanen, J. K. (2008). Is emotional contagion special? An fMRI study on neural systems for affective and cognitive empathy. *Neuroimage*, 43(3), 571-580.
- O'Connor, P. G., Selwyn, P. A., & Schottenfeld, R. S. (1994). Medical care for injection-drug users with human immunodeficiency virus infection. *New England Journal of Medicine*, 331(7), 450-459.
- Oh, S. Y., Bailenson, J., Weisz, E., & Zaki, J. (2016). Virtually old: Embodied perspective taking and the reduction of ageism under threat. *Computers in Human Behavior*, 60, 398-410.
- Palepu, A., Tyndall, M. W., Leon, H., Muller, J., O'shaughnessy, M. V., Schechter, M. T., & Anis, A. H. (2001). Hospital utilization and costs in a cohort of injection drug users. *Canadian Medical Association Journal*, 165(4), 415-420.
- Pan, X., & Slater, M. (2011, July). Confronting a moral dilemma in virtual reality: a pilot study. In *Proceedings of the 25th BCS Conference on Human-Computer Interaction* (pp. 46-51). British Computer Society.
- Peck, T. C., Seinfeld, S., Aglioti, S. M., & Slater, M. (2013). Putting yourself in the skin of a black avatar reduces implicit racial bias. *Consciousness and cognition*, 22(3), 779-787.
- Pettey, C. (2018, September). *3 Reasons Why VIRTUAL-REALITY and AR Are Slow to Take Off*. Retrieved from <https://www.gartner.com/smarterwithgartner/3-reasons-why-virtual-reality-and-ar-are-slow-to-take-off/>
- Philbin, M. M., Mantsios, A., Lozada, R., Case, P., Pollini, R. A., Alvelais, J., ... & Strathdee, S. A. (2009). Exploring stakeholder perceptions of acceptability and feasibility of needle exchange programmes, syringe vending machines and safer injection facilities in Tijuana, Mexico. *International Journal of Drug Policy*, 20(4), 329-335.
- Pimentel, K., & Teixeira, K. (1993). *Virtual Reality: Through the new looking glass*. Windcrest.
- Potier, C., Laprévote, V., Dubois-Arber, F., Cottencin, O., & Rolland, B. (2014). Supervised injection services: what has been demonstrated? A systematic literature review. *Drug and alcohol dependence*, 145, 48-68.
- Price, M., & Anderson, P. (2007). The role of presence in virtual reality exposure therapy. *Journal of anxiety disorders*, 21(5), 742-751.
- Regan, D. T., & Totten, J. (1975). Empathy and attribution: Turning observers into actors. *Journal of Personality and social Psychology*, 32(5), 850.
- Regan, E. C., & Price, K. R. (1994). The frequency of occurrence and severity of side-effects of immersion virtual reality. *Aviation, Space, and Environmental Medicine*.

- Regenbrecht, H., & Schubert, T. (2002). Measuring presence in augmented reality environments: design and a first test of a questionnaire. *Porto, Portugal*.
- Reeves, B., Detenber, B., & Steuer, J. (1993). *New television: The effects of big pictures and big sound on viewer responses to the screen*.
- Riva, G., Mantovani, F., Capideville, C. S., Preziosa, A., Morganti, F., Villani, D., ... & Alcañiz, M. (2007). Affective interactions using virtual reality: the link between presence and emotions. *CyberPsychology & Behavior*, 10(1), 45-56.
- Rizzolatti, G., & Craighero, L. (2004). The mirror-neuron system. *Annu. Rev. Neurosci.*, 27, 169-192.
- Robillard, G., Bouchard, S., Fournier, T., & Renaud, P. (2003). Anxiety and presence during VIRTUAL-REALITY immersion: A comparative study of the reactions of phobic and non-phobic participants in therapeutic virtual environments derived from computer games. *CyberPsychology & Behavior*, 6(5), 467-476.
- Rubin, A. M. (2009). Uses and gratifications. *The SAGE handbook of media processes and effects*, 147-159.
- Rüsch, N., Corrigan, P. W., Wassel, A., Michaels, P., Olschewski, M., Wilkniss, S., & Batia, K. (2009). Ingroup perception and responses to stigma among persons with mental illness. *Acta Psychiatrica Scandinavica*, 120(4), 320-328.
- Ryan, M. L. (1999). Immersion vs. interactivity: Virtual reality and literary theory. *SubStance*, 28(2), 110-137.
- Ryan, M. L. (2001). Narrative as virtual reality. *Immersion and Interactivity in Literature*.
- Ryan, M. L. (2015). *Narrative as virtual reality 2: Revisiting immersion and interactivity in literature and electronic media*. (Vol. 2). JHU Press.
- Salmon, A. M., Thein, H. H., Kimber, J., Kaldor, J. M., & Maher, L. (2007). Five years on: What are the community perceptions of drug-related public amenity following the establishment of the Sydney Medically Supervised Injecting Centre?. *International Journal of Drug Policy*, 18(1), 46-53.
- Salmon, A. M., Van Beek, I., Amin, J., Grulich, A., & Maher, L. (2009). High HIV testing and low HIV prevalence among injecting drug users attending the Sydney Medically Supervised Injecting Centre. *Australian and New Zealand journal of public health*, 33(3), 280-283.
- Sanchez-Vives, M. V., & Slater, M. (2005). From presence to consciousness through virtual reality. *Nature Reviews Neuroscience*, 6(4), 332.
- Sas, C., & O'Hare, G. M. (2003). Presence equation: An investigation into cognitive factors underlying presence. *Presence: Teleoperators & Virtual Environments*, 12(5), 523-537.

- Schubert, T., Friedmann, F., & Regenbrecht, H. (2001). The experience of presence: Factor analytic insights. *Presence: Teleoperators & Virtual Environments*, 10(3), 266-281.
- Schubert, T., Friedmann, F., & Regenbrecht, H. (1999). Embodied presence in virtual environments. In *Visual representations and interpretations* (pp. 269-278). Springer, London.
- Schubert, T. W. (2003). The sense of presence in virtual environments: A three-component scale measuring spatial presence, involvement, and realness. *Zeitschrift für Medienpsychologie*, 15(2), 69-71.
- Schuemie, M. J., Bruynzeel, M., Drost, L., Brinckman, M., De Haan, G., Emmelkamp, P. M. G., & Van der Mast, C. A. P. G. (2000). Treatment of acrophobia in virtual reality: A pilot study. In *Conference Proceedings Euromedia* (pp. 271-275).
- Schutte, N. S., & Stilinović, E. J. (2017). Facilitating empathy through virtual reality. *Motivation and emotion*, 41(6), 708-712.
- Seibert, J., & Shafer, D. M. (2018). Control mapping in virtual reality: effects on spatial presence and controller naturalness. *Virtual Reality*, 22(1), 79-88.
- Seymour, N. E., Gallagher, A. G., Roman, S. A., O'Brien, M. K., Bansal, V. K., Andersen, D. K., & Satava, R. M. (2002). Virtual reality training improves operating room performance: results of a randomized, double-blinded study. *Annals of surgery*, 236(4), 458.
- Sheridan, T. B. (1992). Musings on telepresence and virtual presence. *Presence: Teleoperators & Virtual Environments*, 1(1), 120-126.
- Shih, M. J., Stotzer, R., & Gutiérrez, A. S. (2013). Perspective-taking and empathy: Generalizing the reduction of group bias towards Asian Americans to general outgroups. *Asian American Journal of Psychology*, 4(2), 79.
- Shu, Y., Huang, Y. Z., Chang, S. H., & Chen, M. Y. (2019). Do virtual reality head-mounted displays make a difference? A comparison of presence and self-efficacy between head-mounted displays and desktop computer-facilitated virtual environments. *Virtual Reality*, 23(4), 437-446.
- Simon, S. C., & Greitemeyer, T. (2019). The impact of immersion on the perception of pornography: A virtual reality study. *Computers in Human Behavior*, 93, 141-148.
- Singer, T., Seymour, B., O'doherty, J., Kaube, H., Dolan, R. J., & Frith, C. D. (2004). Empathy for pain involves the affective but not sensory components of pain. *Science*, 303(5661), 1157-1162.
- Skorinko, J. L., & Sinclair, S. A. (2013). Perspective taking can increase stereotyping: The role of apparent stereotype confirmation. *Journal of Experimental Social Psychology*, 49(1), 10-18.
- Slater, M. (2003). A note on presence terminology. *Presence connect*, 3(3), 1-5.

- Slater, M., & Sanchez-Vives, M. V. (2016). Enhancing our lives with immersive virtual reality. *Frontiers in Robotics and AI*, 3, 74.
- Small, D. A., & Verrochi, N. M. (2009). The face of need: Facial emotion expression on charity advertisements. *Journal of Marketing Research*, 46(6), 777-787.
- Small, W., Van Borek, N., Fairbairn, N., Wood, E., & Kerr, T. (2009). Access to health and social services for IDU: the impact of a medically supervised injection facility. *Drug and alcohol review*, 28(4), 341-346.
- Song, K., Fiore, A. M., & Park, J. (2007). Telepresence and fantasy in online apparel shopping experience. *Journal of Fashion Marketing and Management: An International Journal*.
- Soto, B., Sánchez-Quijano, A., Rodrigo, L., del Olmo, J. A., García-Bengoechea, M., Hernández-Quero, J. E., ... & González, F. (1997). Human immunodeficiency virus infection modified the natural history of chronic parenterally-acquired hepatitis C with an unusually rapid progression to cirrhosis. *Journal of hepatology*, 26(1), 1-5.
- Spreng, R. N., McKinnon, M. C., Mar, R. A., & Levine, B. (2009). The Toronto Empathy Questionnaire: Scale development and initial validation of a factor-analytic solution to multiple empathy measures. *Journal of personality assessment*, 91(1), 62-71.
- Sri Kalyanaraman, S., Penn, D. L., Ivory, J. D., & Judge, A. (2010). The virtual doppelganger: Effects of a virtual reality simulator on perceptions of schizophrenia. *The Journal of nervous and mental disease*, 198(6), 437-443.
- Stein, M. D., & Sobota, M. (2001). Injection drug users: hospital care and charges. *Drug and alcohol dependence*, 64(1), 117-120.
- Steinicke, F., & Bruder, G. (2014, October). A self-experimentation report about long-term use of fully-immersive technology. In *Proceedings of the 2nd ACM symposium on Spatial user interaction* (pp. 66-69). ACM.
- Sternadori, M. (2017). Empathy may curb bias: Two studies of the effects of news stories on implicit attitudes toward African Americans and Native Americans. *Contemporary Readings in Law and Social Justice*, 9(2), 11-27.
- Stoltz, J. A., Wood, E., Small, W., Li, K., Tyndall, M., Montaner, J., & Kerr, T. (2007). Changes in injecting practices associated with the use of a medically supervised safer injection facility. *Journal of Public Health*, 29(1), 35-39.
- Strike, C., Jairam, J. A., Kolla, G., Millson, P., Shepherd, S., Fischer, B., ... & Bayoumi, A. M. (2014). Increasing public support for supervised injection facilities in Ontario, Canada. *Addiction*, 109(6), 946-953.
- Sucksmith, E., Allison, C., Baron-Cohen, S., Chakrabarti, B., & Hoekstra, R. A. (2013). Empathy and emotion recognition in people with autism, first-degree relatives, and controls. *Neuropsychologia*, 51(1), 98-105.

- Sun, S., Zuo, B., Wu, Y., & Wen, F. (2016). Does perspective taking increase or decrease stereotyping? The role of need for cognitive closure. *Personality and Individual Differences*, 94, 21-25.
- Sundar, S. S., & Limperos, A. M. (2013). Uses and grats 2.0: New gratifications for new media. *Journal of Broadcasting & Electronic Media*, 57(4), 504-525.
- Sylaiou, S., Mania, K., Karoulis, A., & White, M. (2010). Exploring the relationship between presence and enjoyment in a virtual museum. *International journal of human-computer studies*, 68(5), 243-253.
- Takatalo, J., Nyman, G., & Laaksonen, L. (2008). Components of human experience in virtual environments. *Computers in Human Behavior*, 24(1), 1-15.
- Tarrant, M., Calitri, R., & Weston, D. (2012). Social identification structures the effects of perspective taking. *Psychological science*, 23(9), 973-978.
- Teachman, B. A., Gapinski, K. D., Brownell, K. D., Rawlins, M., & Jeyaram, S. (2003). Demonstrations of implicit anti-fat bias: the impact of providing causal information and evoking empathy. *Health psychology*, 22(1), 68.
- Telfer, P., Sabin, C., Devereux, H., Scott, F., Dusheiko, G., & Lee, C. (1994). The progression of HCV-associated liver disease in a cohort of haemophilic patients. *British journal of haematology*, 87(3), 555-561.
- Todd, A. R., & Galinsky, A. D. (2014). Perspective-taking as a strategy for improving intergroup relations: Evidence, mechanisms, and qualifications. *Social and Personality Psychology Compass*, 8(7), 374-387.
- UNAIDS. (2018). *Miles to go: closing gaps, breaking barriers, fighting injustices*. Retrieved from http://www.unaids.org/sites/default/files/media_asset/miles-to-go_en.pdf
- Unnever, J. D., Cullen, F. T., & Fisher, B. S. (2005). Empathy and public support for capital punishment. *Journal of Crime and Justice*, 28(1), 1-34.
- Van der Heijden, H. (2004). User acceptance of hedonic information systems. *MIS quarterly*, 695-704.
- Van Loon, A., Bailenson, J., Zaki, J., Bostick, J., & Willer, R. (2018). Virtual reality perspective-taking increases cognitive empathy for specific others. *PloS one*, 13(8), e0202442.
- Visch, V. T., Tan, E. S., & Molenaar, D. (2010). The emotional and cognitive effect of immersion in film viewing. *Cognition and Emotion*, 24(8), 1439-1445.
- Vorauer, J. D., Hunter, A. J., Main, K. J., & Roy, S. A. (2000). Meta-stereotype activation: Evidence from indirect measures for specific evaluative concerns experienced by members of dominant groups in intergroup interaction. *Journal of Personality and Social Psychology*, 78(4), 690.

- Ware, N. C., Wyatt, M. A., & Tugenberg, T. (2005). Adherence, stereotyping and unequal HIV treatment for active users of illegal drugs. *Social Science & Medicine*, 61(3), 565-576.
- Wenger, L. D., Arreola, S. G., & Kral, A. H. (2011). The prospect of implementing a safer injection facility in San Francisco: Perspectives of community stakeholders. *International Journal of Drug Policy*, 22(3), 239-241.
- Westbury, H. R., & Neumann, D. L. (2008). Empathy-related responses to moving film stimuli depicting human and non-human animal targets in negative circumstances. *Biological psychology*, 78(1), 66-74.
- Witmer, B. G., & Singer, M. J. (1998). Measuring presence in virtual environments: A presence questionnaire. *Presence*, 7(3), 225-240.
- Wood, E., Tyndall, M. W., Zhang, R., Montaner, J. S., & Kerr, T. (2007). Rate of detoxification service use and its impact among a cohort of supervised injecting facility users. *Addiction*, 102(6), 916-919.
- Wood, E., Kerr, T., Small, W., Li, K., Marsh, D. C., Montaner, J. S., & Tyndall, M. W. (2004). Changes in public order after the opening of a medically supervised safer injecting facility for illicit injection drug users. *Cmaj*, 171(7), 731-734.
- Wood, E., Tyndall, M. W., Qui, Z., Zhang, R., Montaner, J. S., & Kerr, T. (2006). Service uptake and characteristics of injection drug users utilizing North America's first medically supervised safer injecting facility. *American journal of public health*, 96(5), 770-773.
- Wood, E., Tyndall, M. W., Lai, C., Montaner, J. S., & Kerr, T. (2006). Impact of a medically supervised safer injecting facility on drug dealing and other drug-related crime. *Substance abuse treatment, prevention, and policy*, 1(1), 13.
- Wright, N. M., & Tompkins, C. N. (2004). Supervised injecting centres. *BMJ: British Medical Journal*, 328(7431), 100.
- Wu, T. L., Gomes, A., Fernandes, K., & Wang, D. (2019). The Effect of Head Tracking on the Degree of Presence in Virtual Reality. *International Journal of Human-Computer Interaction*, 35(17), 1569-1577.
- Wynia, M. K. (2005). Science, faith and AIDS: the battle over harm reduction. *The American Journal of Bioethics*, 5(2), 3-4.
- Yee, N., & Bailenson, J. N. (2006). Walk a mile in digital shoes: The impact of embodied perspective-taking on the reduction of negative stereotyping in immersive virtual environments. *Proceedings of PRESENCE*, 24, 26.
- Yu, C. L., Wang, M. Y., & Hu, J. F. (2016). Valence processing of first impressions in the dorsomedial prefrontal cortex: a near-infrared spectroscopy study. *Neuroreport*, 27(8), 574-579.

Yu, C. L., & Chou, T. L. (2018). A dual route model of empathy: a neurobiological prospective. *Frontiers in psychology*, 9, 2212.

Appendix A
Participant Questionnaire

Presence - Spatial

The following questions refer to your experience going through the virtual reality presentation. The questions refer to how you approached the exercise. Keep in mind, there is no right or wrong to go through the presentation. However, the questions will ask about the types of thoughts you had during the presentation. When responding, please do your best to be as accurate as possible. Please read the statements and respond with how much you agree or disagree.

The presentation made me feel a sense of "being there" in a virtual environment.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agree
- ☐ Strongly agree

During the presentation, I felt like I was completely surrounded by the virtual environment rather than the room I am actually in.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agree
- ☐ Strongly agree

To me, it just seemed like I was looking at pictures in a virtual environment.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agree
- ☐ Strongly agree

During the presentation, I felt present in the virtual environment.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agree
- ☐ Strongly agree

During the presentation, I had a sense that I was acting in a virtual environment, rather than just watching a video.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agree
- ☐ Strongly agree

Presence - Realness

The virtual environment in the presentation seemed realistic to me (i.e., the look, feel, and sounds felt real).

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agree
- ☐ Strongly agree

The virtual environment in the presentation was consistent with my real-world experiences (i.e., the look, feel, and sounds were like those of the real-world).

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agree
- ☐ Strongly agree

The virtual environment in the presentation seemed more realistic than what I would expect to see in the real world.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agree
- ☐ Strongly agree

Presence - Involvement

How aware were you of other people in the room, or nearby rooms, when going through the virtual reality presentation?

- ☐ Not aware at all
- ☐ A little aware
- ☐ Moderately aware
- ☐ Very aware
- ☐ Extremely aware

How aware were you of real-world sounds when going through the virtual reality presentation? (e.g., sounds from other rooms, hallway noise, etc.).

- ☐ Not aware at all
- ☐ A little aware
- ☐ Moderately aware
- ☐ Very aware
- ☐ Extremely aware

How aware were you of the furniture in the real-world environment when going through the virtual reality presentation? (e.g., couches, lamps, rug, etc.).

- ☐ Not aware at all
- ☐ A little aware
- ☐ Moderately aware
- ☐ Very aware
- ☐ Extremely aware

When I was going through the virtual reality presentation, I was not aware of my real environment.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agree
- ☐ Strongly agree

When I was in the virtual environment, I was completely captivated.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agree
- ☐ Strongly agree

Empathy - Personal distress

The following questions are about your experience near the beginning of the presentation, when the injection drug user overdoses. Read each statement and respond with how much the statement does or does not describe your experience. The overdose made me feel...

	Does not describe my experience at all	Describes my experience a little	Describes my experience moderately	Describes my experience a lot	Describes my experience completely
Anxious	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Helpless	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Calm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scared	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
As if I couldn't handle the emergency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Like I was loosing control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Like I was falling to pieces	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Empathy - Perspective taking

The following questions are about your overall experience with the presentation. Read each statement and respond with how much the statement does or does not describe your experience. While going through the presentation...

	Does not describe my experience at all	Describes my experience a little	Describes my experience moderately	Describes my experience a lot	Describes my experience completely
I imagined myself to be in the situation of an injection drug user	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I saw things from the point of view an injection drug user	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tried to take the perspective of an injection drug user	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I thought about the injection drug user's side of things when being introduced to the supervised injection facilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I listened closely to the narrator about the benefits of supervised injection facilities to see if they could help injection drug users	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Empathy - Fantasy

Again, the following questions are about your overall experience with the presentation. Read each statement and respond with how much the statement does or does not describe your experience. While going through the presentation, I felt myself...

	Does not describe my experience at all	Describes my experience a little	Describes my experience moderately	Describes my experience a lot	Describes my experience completely
Fantasizing about things that might happen to me if I were an injection drug users	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Become involved with the feelings of injection drug users	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Become completely caught up in the story of the video	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Watching the video as if I was an injection drug user	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Take the place of an injection drug user	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Imagine how I would feel if the events in the story were happening to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Empathic concern

The next questions are about how you feel toward injection drug users.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I feel touched when injection drug users get help	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel sorry for injection drug users when they are having problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel protective toward injection drug users when they are subject to scrutiny	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel soft-hearted toward injection drug users	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel pity for injection drug users when they are treated unfairly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel concerned for injection drug users who are less fortunate than me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am disturbed by the misfortunes of injection drug users	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Level of Public Support

The next set of questions are about your attitudes toward supervised injection facilities in Colorado. Please read each question and respond with how much you agree or disagree.

Supervised injection facilities should be made available to injection drug users in Colorado if they can...

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Reduce overdose deaths	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increase drug users' contact with health and social workers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reduce neighborhood problems related to injection drug use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reduce infectious disease among users	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Supervised injection facilities should be legal in Colorado.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agree
- ☐ Strongly agree

Stereotypes Toward Injection Drug Users

Read each statement and respond with how much you agree or disagree. Injection drug users...

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Live chaotic lives	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are weak-willed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are immoral	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are dangerous	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are irresponsible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are unreliable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are unemployable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Enjoyment

The following questions ask about how much you enjoyed using the Oculus virtual reality system to watch the presentation. Please respond with how much you agree or disagree with each statement. Going through the presentation in virtual reality was...

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Enjoyable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Exciting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pleasant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Interesting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

VIRTUAL-REALITY Sickness

The following question asks about any physically symptoms you may or may not have felt when watching the presentation. Read each statement and respond with how much the statement does or does not describe your experience. When watching the presentation, I felt...

	Does not describe my experience at all	Describes my experience a little	Describes my experience moderately	Describes my experience a lot	Describes my experience completely
General discomfort	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nauseous	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A headache	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Disoriented	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My stomach becoming aware	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Frequency of VIRTUAL-REALITY HMD / 360 Video

How frequently do you use head-mount display virtual reality systems such as Oculus, Sony Playstation VIRTUAL-REALITY, or Samsung Odyssey? <div> </div>

- ☐ I have never used one (not including today)
- ☐ I have used one once or twice before
- ☐ I use one monthly
- ☐ I use one weekly
- ☐ I use one more than once a week

How frequently do you use / watch 360-degree videos such as YouTube 360, Facebook 360, or Google Arts and Culture?

- ☐ I have never seen a 360 video (not including today)
- ☐ I have watched a 360 video once or twice before
- ☐ I watch a 360 video monthly
- ☐ I watch a 360 video weekly
- ☐ I watch a 360 video more than once a week

Drug Use History

Does a close friend or family member have a history of injection drug use (e.g., heroin, fentanyl)?

☐ Yes

☐ No

Have you used alcohol at least once in the last year?

☐ Yes

☐ No

Within the last 30 days, how often have you used alcohol?

☐ Never

☐ Once or twice

☐ A couple times a week

☐ Nearly every day

☐ Every day

Have you used non-prescribed benzodiazepines (such as Xanax, Valium, or Ativan) at least once in your life?

☐ Yes

☐ No

Within the last 30 days, how often have you used non-prescribed benzodiazepines?

☐ Never

☐ Once or twice

☐ A couple times a week

☐ Nearly every day

☐ Every day

Have you used cannabinoids (such as marijuana or hashish) at least once in your life?

☐ Yes

☐ No

Within the last 30 days, how often have you used cannabinoids?

- ☐ Never
- ☐ Once or twice
- ☐ A couple times a week
- ☐ Nearly every day
- ☐ Every day

Have you used opioids (such as heroin, fentanyl, oxycodone, etc.) at least once in your life?

- ☐ Yes
- ☐ No

Within the last 30 days, how often have you used opioids?

- ☐ Never
- ☐ Once or twice
- ☐ A couple times a week
- ☐ Nearly every day
- ☐ Every day

Have you used barbiturates (such as Amytal, Luminal, or Pentobarbital) at least once in your life?

☐ Yes

☐ No

Within the last 30 days, how often have you used barbiturate

☐ Never

☐ Once or twice

☐ A couple times a week

☐ Nearly every day

☐ Every day

Have you used speed stimulants (such as cocaine, crack cocaine, or methamphetamines) at least once in your life?

☐ Yes

☐ No

Within the last 30 days, how often have you used speed stimulants?

☐ Never

☐ Once or twice

☐ A couple times a week

☐ Nearly every day

☐ Every day

Have you used hallucinogens (such as Ecstasy, Psilocybin mushrooms, LSD, etc.) at least once in your life?

☐ Yes

☐ No

Within the last 30 days, how often have you used hallucinogens?

☐ Never

☐ Once or twice

☐ A couple times a week

☐ Nearly every day

☐ Every day

Demographics

In this last section, we will ask you a few questions about yourself. Please take a moment to answer the following questions.

Are you of Hispanic, Latino, or Spanish origin? (Select all that apply)

- ☐ No
- ☐ Yes, Mexican, Mexican Am., Chicano
- ☐ Yes, Puerto Rican
- ☐ Yes, Cuban
- ☐ Yes, another Hispanic, Latino, or Spanish origin
- ☐ Prefer not to answer

Please indicate your race. (Select all that apply)

- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Pacific Islander
- ☐ White
- ☐ Other
- ☐ Prefer not to answer

What is your race?

To which gender identity do you most identify?

- ☐ Female
- ☐ Male
- ☐ Transgender female
- ☐ Transgender male
- ☐ Gender non-conforming
- ☐ Prefer not to say

What is your age?

Have you ever been diagnosed with a mental illness by a mental health professional (e.g., nurse, doctor, counselor, etc.)?

☐ Yes

☐ No

In politics today, how do you describe yourself?

☐ Democrat

☐ Republican

☐ Independent

☐ Something else

☐ Prefer not to answer